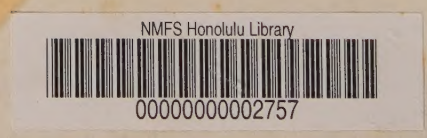
Library
NOAA, National Marine Fisheries Service
SWFC Honolu... ...boratory F/SWC2
2570 Dole Street
Honolulu, HI 96822-2396

QL638
A

Jordan.
Studies in Ichthyology;
Atherinidae or silversides.

1919

...RARY
... OF COMM. FISH.
... BIOL. LAB.



Library
NOAA, National Marine Fisheries Service
SWFC Honolulu Laboratory F/SWC2
2570 Dole Street
Honolulu, HI 96822-2396

LELAND STANFORD JUNIOR UNIVERSITY PUBLICATIONS
UNIVERSITY SERIES

Studies in Ichthyology

A Monographic Review of the Family of Atherinidae or Silversides

BY

DAVID STARR JORDAN
Chancellor-Emeritus of Stanford University

AND

CARL LEAVITT HUBBS
Curator of Fishes, Field Museum

STANFORD UNIVERSITY, CALIFORNIA
PUBLISHED BY THE UNIVERSITY
DECEMBER 18, 1919

UNIVERSITY SERIES

INHERITANCE IN SILKWORMS, I. Vernon Lyman Kellogg, Professor of Entomology. 89 pp., 4 plates. 1908. Price $1.00.

THE OPISTHOBRANCHIATE MOLLUSCA OF THE BRANNER-AGASSIZ EXPEDITION TO BRAZIL. Frank Mace McFarland, Professor of Histology. 105 pp., 19 plates. 1909. Price $1.00.

A STUDY OF THE NORMAL CONSTITUENTS OF THE POTABLE WATER OF THE SAN FRANCISCO PENINSULA. John Pearce Mitchell, Assistant Professor of Chemistry. 70 pp., 1 map. 1910. Price 50c.

SYNOPSIS OF THE TRUE CRABS (BRACHYURA) OF MONTEREY BAY, CALIFORNIA. Frank Walter Weymouth. 64 pp., 14 plates. 1910. Price 50c.

THE OSTEOLOGY OF CERTAIN SCOMBROID FISHES. Edwin Chapin Starks, Assistant Professor of Zoology. 49 pp., 2 plates, 1 text figure. 1911. Price 50c.

A PHYSICAL THEORY OF ELECTRIFICATION. Fernando Sanford, Professor of Physics. 69 pp., 2 plates. 1911. Price 50c.

THE MATZKE MEMORIAL VOLUME. Papers by John Ernst Matzke, late Professor of Romanic Languages, and Thirteen Colleagues. 162 pp. 1911. Price $1.00.

DAS HISTORISCHE PRÄSENS IN DER ÄLTEREN DEUTSCHEN SPRACHE. Bruno Boezinger, Assistant Professor of Germanic Languages. 91 pp. 1912. Price 50c.

THE EFFECT OF A STRICTLY VEGETABLE DIET ON THE SPONTANEOUS ACTIVITY, THE RATE OF GROWTH, AND THE LONGEVITY OF THE ALBINO RAT. James Rollin Slonaker, Assistant Professor of Physiology. 36 pp., 1 plate, 15 text figures. 1912. Price 50c.

CATALOGUE DE TOUS LES LIVRES DE FEU M. CHAPELAIN. (Bibliothèque Nationale. Fonds Français, Nouv. Acq., No. 318.) Colbert Searles, Associate Professor of Romanic Languages. 119 pp., 2 plates. 1912. Price 75c.

THE DUDLEY MEMORIAL VOLUME. Papers by William Russell Dudley, late Professor of Botany, and Several Colleagues. 137 pp., 12 text figures, 9 plates. 1913. Price $1.00.

THE FISHES OF THE STANFORD EXPEDITION TO BRAZIL. Edwin Chapin Starks, Assistant Professor of Zoology. 77 pp., 15 plates. 1913. Price 75c.

THE BIRDS OF THE LATIN POETS. Ernest Whitney Martin, Associate Professor of Greek. 260 pp. 1914. Price $1.00.

ACCELERATION IN THE DEVELOPMENT OF THE FOSSIL CEPHALOPODA. James Perrin Smith, Professor of Paleontology. 30 pp., 15 plates. 1914. Price 75c.

A MORPHOLOGICAL STUDY OF SOME MEMBERS OF THE GENUS PALLAVICINIA. Douglas Houghton Campbell, Professor of Botany, and Florence Williams. 44 pp., 23 text figures. 1914. Price 50c.

THE EVOLUTION OF BRAZIL COMPARED WITH THAT OF SPANISH AND ANGLO-SAXON AMERICA. Manuel de Oliveira Lima, Minister of Brazil to Belgium. 160 pp. 1914. Price $1.00.

THE HEMOLYMPH NODES OF THE SHEEP. Arthur William Meyer, Professor of Anatomy. 74 pp., 1 plate, 4 colored plates. 1914. Price $1.00.

AN INTRODUCTION TO THE STUDY OF THE ENDOCRINE GLANDS AND INTERNAL SECRETIONS. (Lane Medical Lectures.) Sir Edward Schäfer, Regius Professor of Physiology in the University of Edinburgh. 94 pp., 1914. Price 75c.

THE PRONOUN OF ADDRESS IN ENGLISH LITERATURE OF THE THIRTEENTH CENTU Arthur Garfield Kennedy, Instructor in English Philology. 91 pp. 19 Price $1.00.

THE ANOPLURA AND MALLOPHAGA OF NORTH AMERICAN MAMMALS. Vernon Lyma Kellogg, Professor of Entomology, and Gordon Floyd Ferris. 74 pp., 18 text figures, 8 plates. 1915. Price 75c.

THE FLÜGEL MEMORIAL VOLUME. Papers by Ewald Flügel, late Professor of English Philology, his Colleagues and Students. 232 pp. 1916. Price $1.50.

(Continued on third page of cover.)

LELAND STANFORD JUNIOR UNIVERSITY PUBLICATIONS
UNIVERSITY SERIES

Studies in Ichthyology

A Monographic Review of the Family of Atherinidae or Silversides

BY

DAVID STARR JORDAN
Chancellor-Emeritus of Stanford University

AND

CARL LEAVITT HUBBS
Curator of Fishes, Field Museum

Library
NOAA, National Marine Fisheries Service
SWFC Honolulu Laboratory F/SWC2
2570 Dole Street
Honolulu, HI 96822-2396

STANFORD UNIVERSITY, CALIFORNIA
PUBLISHED BY THE UNIVERSITY
DECEMBER 18, 1919

QL638
.A

231[10]

STANFORD UNIVERSITY
PRESS

CONTENTS

	PAGE
Atherinidæ or Silversides	5
Families of Percesoces	6
Fossil Atherinidæ	9
Rhamphognathus	9
Mesogaster	10
Zanteclites	10
Genera of Atherinidæ	12
Nannatherina	19
Bedotia	19
Rheocles	20
Centratherina	21
Chilatherina	22
Anisocentrus	22
Rhombosoma	23
Melanotænia	24
Glossolepis	26
Rhadinocentrus	27
Atherinosoma	27
Pseudomugil	28
Telmatherina	29
Atherion	29
Hepsetia	31
Atherina	35

	PAGE
Genera of Atherinidæ (Con't):	
Craterocephalus	42
Iso	47
Menidia	49
Archomenidia	54
Hubbesia	56
Membras	56
Thyrina	58
Thyrinops	61
Atherinella	62
Eurystole	62
Pseudothyrina	63
Kronia	63
Odontesthes	64
Austromenidia	64
Chirostoma	68
Leuresthes	81
Labidesthes	83
Xenatherina	83
Colpichthys	84
Atherinops	84
Atherinopsis	85
Basilichthys	86

A MONOGRAPHIC REVIEW OF THE FAMILY OF ATHERINIDÆ OR SILVERSIDES

By David Starr Jordan and Carl Leavitt Hubbs

The present paper contains a review of the genera, with an annotated list of the known species, of the fishes of the family Atherinidæ, known as "Silversides" in the eastern United States; as "Hardyheads" in Australia; as "Joel," "Sauclet," etc., in France; "Epseto" and "Lattarina" in Italy, and throughout Latin America as "Fishes of the King" (Pesce-re, Peixe-rei, Pexerey, Pescado del Rey, Peje-rei, Peje-rey, Pejerrey). The majority of the species are tropical, though many are found within the temperate zones. Some are marine living along sandy shores, some in the sluggish estuaries of rivers, a few in mountain torrents, or lakes; seldom in muddy water. None are known from the depths of the ocean: they are closely confined everywhere, both to the surface and to the shore-line. The species are usually small, the tropical ones almost uniformly so, attaining a length of from two to six inches; in the temperate regions of the New World some reach a length of between one and two feet.

For more than seventy-five years after the tenth edition of the *Systema Naturæ* was published, Atherina remained the only named genus of its group. The first generic divisions were made by Bonaparte in 1837; by Swainson, in 1839; by Bleeker, in 1853; and by Girard, in 1854. In his *Catalogue,* however, Günther (1861) recognized but two genera, Atherina and an unnatural assemblage for which he chose the name Atherinichthys. Since that time, however, numerous genera have been described. In the present review, we accept 38 genera and two subgenera as valid. Similarly most of the species remained long unknown. Linnæus knew but one, Atherina hepsetus. Valenciennes in 1835 listed 28 species; Günther in 1861 described but 38. Considering only the North and Middle American species, Jordan and Evermann in 1896 accepted 34. We now list 149 species and subspecies.

List of the New Subfamilies, Genera and Species Described in This Paper

Nannatherininæ, new subfamily
Bedotiinæ, new subfamily.
Rheoclinæ, new subfamily.
Atherion maccullochi, new species.

ARCHOMENIDIA, new genus (SALLEI).
CHIROSTOMA REGANI, new species.
CHIROSTOMA CONSOCIUM, new species.

The ATHERINIDÆ find their place in the suborder PERCESOCES, a group which, from time to time, has been variously enlarged to include a number of unrelated families. It should apparently be restricted, at least insofar as the living forms are involved, to include only the SPHYRÆNIDÆ (Barracudas), MUGILIDÆ (Mullets), and the ATHERINIDÆ. The peculiar fishes comprising the family POLYNEMIDÆ (RHEGNOPTERI, or POLYNEMOIDEA) are superficially much like the MUGILIDÆ, and structurally resemble the PERCESOCES, especially the SPHYRÆNIDÆ, quite closely.[1] The two groups should perhaps be united to form the primary subdivisions (MUGILOIDEA, POLYNEMOIDEA) of the PERCESOCES. The relationships of the ATHERINIDÆ to the MUGILIDÆ and SPHYRÆNIDÆ are indicated by the following analytical key:

Key to the Families of the Percesoces

a[1]. Lateral line present, continuous; pectoral fin placed rather low; mouth usually larger, with stronger teeth, especially on the palate; teeth implanted in deep sockets; maxillary with a supplementary bone forming a knob-like projection posteriorly; "third and fourth superior pharyngeals separate; supraclavicle not reduced in size; lower limb of post-temporal not attached to opisthotic by suture; exoccipitals meeting above basioccipital; alisphenoids meeting; ethmoid a thin plate, entirely superior, extending to and forming edge of rostrum; anterior neural spines normal; parapophyses not developed on anterior vertebræ,"[2] directed downward; vertebræ 24.....SPHYRÆNIDÆ

a[2]. Lateral line absent, or very incompletely and irregularly developed; pectoral fin placed high (NANNATHERINA excepted); mouth generally smaller, usually with fine teeth, which are never imbedded in deep sockets;[3] palatine teeth fine (ATHERINOSOMA excepted), or absent; no supplementary bone on maxillary; "third and fourth superior pharyngeals of each side anchylosed; supraclavicle reduced in size; lower limb of post-temporal attached to opisthotic by ligament or suture; exoccipitals not meeting above basioccipital; alisphenoids not meeting; ethmoid normal, not overlying prefrontals and vomer or extending to lateral edge of rostrum; anterior neural spines laterally flattened; parapophyses developed on all abdominal vertebræ" (Starks, *l. c.*), directed outward.

b[1]. Vertebræ 24 to 26; anal fin with two or three spines; head more obtuse; "lower limb of post-temporal attached to cranium by dentate suture; basisphenoid absent; myodome not opening to exterior posteriorly; foramen magnum region produced; superior pharyngeals of complex shape, not bearing teeth" (Starks, *l. c.*).....MUGILIDÆ

---

[1] Regan, *Proc. Internat. Zool. Congr.*, **7**, 847, 1907 (1912; adv. prints 1910).

[2] Starks, *Proc. U. S. Nat. Mus.*, **22**, 1-10, pls. 1-3, 1910 (October 7, 1899).

[3] In some species of CHIROSTOMA, as C. SPHYRÆNA, the gape is wide, and the teeth strong and set in shallow sockets, thus approaching those of SPHYRÆNA.

b[2]. Vertebræ more than 30; anal fin with a single spine (3 in NANNATHERINA); head sharp; "lower limb of post-temporal attached to opisthotic by ligament; basisphenoid developed; myodome opening to exterior posteriorly; region about foramen magnum not produced; superior pharyngeals typical in shape, bearing teeth" (Starks, *l. c.*).....ATHERINIDÆ

It is evident from the foregoing analysis that each of the three families possesses certain primitive traits, and that each is highly modified in its own direction.

The PERCESOCES have usually been defined as teleost fishes with cycloid scales, a spinous dorsal, and with ventral fins composed of a spine and five soft rays, subabdominal in position. A view of their relationships which has long remained in favor was expressed by Jordan and Evermann[4] in these words: "The suborder marks a transition from soft-rayed to spiny-rayed fishes, its nearest relatives among the latter being, perhaps, the Scombroid forms." Professor E. C. Starks, in a paper on "The Osteological Characters of the Fishes of the suborder PERCESOCES,"[5] wrote:

"In examining the crania of these species attention is attracted at once to the fact that in all of them the epiotics are developed into long, thin processes which divide into more or less bristle-like filaments.

"There is little else in purely internal characters whereby to differentiate these families as a group from the other ACANTHOPTERI. In order so to differentiate them we must turn to the well-known external characters—a spinous dorsal in conjunction with the abdominal ventral fins, high pectoral fins and unarmed opercles."

The taxonomic value of these minor differences may be questioned, inasmuch as the PERCESOCES are so like the typical percoid fishes in general structure. Unarmed opercles, not being rare in the PERCOIDEA, offer no substantial character upon which to define the group. Similarly the scales of many percoids, having lost their armature, are secondarily cycloid; in some of these cases, as in certain EMBIOTOCIDÆ, the finer structure of the scale is closely similar to that of the PERCESOCES: consequently the scales of this group may have developed from a typical ctenoid type. The pectoral bases, especially in the MUGILIDÆ and ATHERINIDÆ, are higher and more oblique than in typical perch-like fishes, but in one genus of the ATHERINIDÆ, NANNATHERINA, the pectorals are "Symmetrical, rounded, placed rather low (as in normal Perciform fishes rather than as in other Atherinids)."[6] The flexibility of the dorsal spines in the PERCESOCES, and their separation from the soft rays as a distinct fin, are characters paralleled in several groups of obviously per-

[4] *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 788, 1896.

[5] *Proc. U. S. Nat. Mus.*, **22**, 1-10, pls. 1-3, 1900 (Oct. 7, 1899).

[6] Regan, *Ann. Mag. Nat. Hist.* (7), **18**, 451, 1906.

coidean ancestry; moreover, in NANNATHERINA the dorsals are joined at their base, and in other genera of the ATHERINIDÆ the dorsals are closely approximated; in the MUGILIDÆ and in certain genera of the ATHERINIDÆ (NANNATHERINA, CENTRATHERINA), the dorsal spines are all pungent. The caudal fin of the PERCESOCES has been described as diphycercal, but in SPHYRÆNA, as in many typical percoids, only two of the neural and hæmal spines enter into the support of the procurrent caudal rays; in the ATHERINIDÆ, in which the vertebræ are increased in number, more vertebral spines (four in CHIROSTOMA HUMBOLDTIANUM) are included in the skeletal base of the caudal fin. There remains of the known diagnostic features of the PERCESOCES but one, namely the abdominal position of the ventral fins, which indicates a close relationship with the soft-rayed fishes. In the MUGILIDÆ and in certain ATHERINIDÆ, however, the pelvic bones are close to the pectoral arch: the ventral fins are "subabdominal." Moreover the pelvic bones of these forms are attached by ligament to the pectoral girdle, a fact which has led Dollo[7] to consider the ventrals of the ATHERINIDÆ to be secondarily abdominal. Regan[8] likewise, has recently included the PERCESOCES among the PERCOMORPHI of his system. The lack of the orbitosphenoid in the PERCESOCES; the number of caudal rays (15 branched, 17 in all, excluding the procurrent rays); the number of anal spines (three in most of the MUGILIDÆ and in NANNATHERINA, fewer in the other forms; the constant occurrence of a spine and five soft rays in the ventral fin, point positively to the same conclusion, namely, that the PERCESOCES are of percoidean ancestry, and that the group is not transitional between the soft-rayed and the spiny-rayed fishes.

If the PERCESOCES are of percoidean ancestry, as the foregoing evidence leads us to believe, then we have some basis upon which to determine the most probable evolutionary sequence of the genera within the family ATHERINIDÆ. The most evidently perch-like, and consequently very probably the most primitive of the atherine fishes, is NANNATHERINA[9], a fresh-water fish of Western Australia: its perch-like features are its moderately robust body; wide mouth; eight or nine pungent spines in first dorsal; the connection of the two dorsals; three anal spines; symmetrical, rounded, low pectorals; anteriorly inserted ventrals; 31 (14+17) vertebræ, fewer than in any other atherine so far as known. BEDOTIA, from the mountain streams of Madagascar, resembles NANNATHERINA and differs from other atherine genera in having the caudal rounded, and in having the premaxillaries little protractile; as in that

[7] *Verh. Zool.-bot. Ges. Wien*, **59**, 135–140, 1909.

[8] *Ann. Mag. Nat. Hist.* (8), **12**, 111, 1913.

[9] Regan, *Ann. Mag. Nat. Hist.* (7), **18**, 451, 1906.

genus, the gill-rakers are greatly reduced, the body is rather robust, the mouth large, the ventrals inserted forward; the dorsal fins are separated, however, and the structure of the mouth is peculiar. In RHEOCLES, which also inhabits the fresh waters of Madagascar, the dorsal fins are closely approximated, the caudal is emarginate and the structure of the mouth is normal, the body robust; both BEDOTIA and RHEOCLES thus show relationships with NANNATHERINA. In the MELANOTÆNIINÆ of the fresh waters of Australia, New Guinea, and neighboring islands, the body is typically robust, the ventrals inserted well forward, the dorsals closely approximated, and the first dorsal spine usually pungent. In one genus, CENTRATHERINA, the spines are all pungent; in RHADINOCENTRUS all are flexible, as also in TELMATHERINA and PSEUDOMUGIL, genera which show an approach toward the more typical members of the subfamily ATHERININÆ. The large group of genera comprising the ATHERINOPSINÆ, and confined wholly to the Americas, are doubtless derived from the ATHERININÆ. Each of these groups of the ATHERINIDÆ, however, is specialized in its own way: NANNATHERINA and BEDOTIA have the caudal rounded, and the premaxillaries little protractile; BEDOTIA has the mouth peculiar in structure; RHEOCLES has few and very short gill-rakers; most of the MELANOTÆNIINÆ have the anal fin greatly elongate and the belly unusually short; the ATHERININÆ have the anus usually inserted forward of its normal position; the ATHERINOPSINÆ have the gape arched and the premaxillaries widely dilated posteriorly. Of all the groups however, the ATHERINOPSINÆ are the least perch-like, and for that reason may be placed at the end of the series.

Despite the wide range of variation exhibited by them, the numerous genera of the ATHERINIDÆ (NANNATHERINA perhaps excepted) form a compact and obviously natural group. The few fossils known appear to belong in or near ATHERINA or in one case perhaps approaching MELANOTÆNIA.

Of the fossil ATHERINIDÆ, not much is known. The type is not ancient and may be as already suggested a comparatively modern offshoot from ancestors of the APOGONIDÆ, or AMBASSIDÆ.

The European fossils from the Upper Eocene and Miocene referred to ATHERINA seem to belong to that genus or to HEPSETIA which as fossil could hardly be distinguished.

A second genus, RHAMPHOGNATHUS Agassiz, has the jaws produced, the snout ending in an acute point. In this form, as in ATHERINA, the premaxillary border is straight, not curved as in LABIDESTHES and American forms generally. RHAMPHOGNATHUS PARALEPOIDES Agassiz is from the Upper Eocene, at Monte Bolca, Verona.

Another species from the same locality, called MESOGASTER SPHYRÆNOIDES Agassiz, has also a produced snout, the premaxillary border being straight, as in ATHERINA, not curved as in most American forms. MESOGASTER is a less elongate fish than RHAMPHOGNATHUS, but it belongs to the general ATHERINA type.

In a paper lately published,[10] Dr. David Starr Jordan and J. Z. Gilbert describe a new genus of fossil ATHERINIDÆ from the Monterey Miocene deposits of Southern California. This genus, ZANTECLITES, (HUBBSI) in its relatively few vertebræ, in the approximation of the dorsal fins, and in the comparatively large and subfilamentous first dorsal, suggests certain genera living in Australia and Madagascar, which, as we have already indicated, may be among the more primitive forms of this type.

ZANTECLITES HUBBSI Jordan and J. Z. Gilbert (*l. c.* 39)

(Plate XI, Fig. 40)

A little fish about four inches long, from the Puente diatomaceous shales (Miocene) at Elmodena, Orange County, and at Shorb, Los Angeles County, California, almost certainly belongs to the ATHERINIDÆ. It is referable, however, to neither the ATHERININÆ nor the ATHERINOPSINÆ, the two groups now living in the Holarctic Realm, being more primitive than any of the genera of either subfamily. Its primitive features at once apparent are the relatively few vertebræ, the approximation of the dorsal fins, and the relatively large first dorsal fin composed of spines comparatively well spaced and fairly robust basally. Among living genera ZANTECLITES bears the closest resemblance to RHEOCLES of Madagascar and PSEUDOMUGIL of Australia and New Guinea, types which we regard as relatively primitive among the ATHERINIDÆ. From both of these genera ZANTECLITES is sufficiently distinguished by the characters of the dorsal fins.

In the type-specimen of ZANTECLITES HUBBSI the tail and trunk are well preserved by a rather clear impression in the diatomaceous shale, but the head has been crushed so that the cranium is seen in dorsolateral aspect, while the opercles and shoulder girdle are below their normal position.

The top of the cranium resembles that of ATHERINA rather closely, the wide supraorbital laminæ being separated from the rest of the frontal by deep grooves widely divergent posteriorly. The length of the cranium to the anterior end of the frontal bone appears to be contained four

[10] *Fossil Fishes of Southern California*, by David Starr Jordan and James Zaccheus Gilbert, Leland Stanford Jr. University Publications, 1919.

times in the length of the vertebral column, the interorbital width, about 10 or 11 times. The snout and jaws are not preserved in this specimen. Another, from Shorb, shows the mouth oblique, of moderate extent; the outline of the premaxillary nearly straight, a little curved forward at tip.

Vertebræ $16 + 19 + 1 = 36$, the precaudal portion scarcely shorter than the caudal. Apparently all of the precaudals bear pleurals, and traces of epipleurals persist. The neural and hæmal spines are rather short, and the vertebræ are rather slender. As in ATHERINA, the spines from about five vertebræ support the procurrent caudal rays, the uppermost and lowermost of the principal caudal rays impinging on the tips of the hypural. This is an important family character.

Spinous dorsal well developed, and submedian in position, its origin probably being a little nearer tip of snout than base of caudal. Spines VIII, rather crowded, but more widely spaced than in the ATHERININÆ or ATHERINOPSINÆ, supported by interneurals attached apparently to the neural spines of vertebræ 6 to 12. First dorsal spine short, the second about as long as base of fin, the rest elongate, and evidently filamentous distally, about as high as the body is deep. Second dorsal adjacent to the first dorsal, its first ray (probably a slender spine) attached to the interneural immediately following the one supporting the last spine of the first dorsal; four or five other rays can be distinguished, the height of the longest perhaps a little greater than length of first dorsal base.

Caudal fin forked, each lobe so far as preserved a little shorter than depth of body or height of dorsal spines; uppermost and lowermost developed rays robust and simple; the other rays branched, becoming more slender toward middle of fin. The procurrent caudal rays are well developed.

Anal fin short, falcate in outline, its height about equal to depth of caudal peduncle. The first ray is probably a short spine similar to the first in the spinous dorsal, and is followed by about 10 or 11 longer rays. The origin of the anal is considerably posterior to that of the second dorsal.

The pectoral is obviously represented by several detached rays and by two rays which appear to be *in situ* at the lower hinder end of the pectoral base, opposite the angle near the upper end of the clavicle, but rather distant from it. The fin is narrow and long, as long as the head. In its position it resembles closely that of the living ATHERINIDÆ (NANNATHERINA excepted) in its oblique base and high insertion. The hypocoracoid is seemingly represented, as in ATHERINA, by a large plate. (The ventral fins do not show in the photograph, but part of the fin is

fairly evident in the actual type-specimen. They are inserted nearly midway between base of pectoral and that of anal, under the fifteenth vertebra.)

The scales are large and round, without trace of apical teeth; they are evident over most of the body, and are about as numerous in median series as the vertebræ.

By including in the following key the ranges of the several subfamilies and the numerous genera comprising the family ATHERINIDÆ, we indicate the main features of the geographical distribution of these fishes.

ANALYSIS OF THE LIVING GENERA OF ATHERINIDÆ.

a^1. NANNATHERININÆ: Anal fin composed of three spines and eight or nine soft rays, opposite the first dorsal and similar to it; dorsal fins joined at base, the first of eight or nine pungent spines; pectorals symmetrical, rounded, placed rather low; the ventrals inserted near pectorals; caudal rounded; vertebræ 31; body comparatively robust; mouth wide, oblique, the maxillary exposed distally and extending to below the eye; premaxillaries little protractile; teeth on jaws, vomer, and palatines; gill-rakers reduced to short projections. *Streams of Western Australia*..... 1. NANNATHERINA.

a^2. Anal fin with a single spine, its origin usually in advance of that of second dorsal; dorsal fins separate, the first usually with fewer than eight spines, usually flexible; pectorals scythe-shaped, pointed, inserted high; vertebræ, so far as known, more numerous.

b^1. BEDOTIINÆ: Caudal fin truncate and rounded; dorsal fins separated, the first of five flexible spines, originating slightly in advance of anal; anal fin composed of a spine and 14 to 19 soft rays; ventrals inserted not far behind pectorals; body rather robust; head naked; mouth large, extending to below eye, lower jaw projecting; premaxillaries little protractile, the anterior part separated by a notch from the lateral. *Streams of Madagascar*.....2. BEDOTIA.

b^2. Caudal fin forked; head scaly, at least on sides; premaxillaries fully protractile, the anterior part not separated by a notch from the lateral.

c^1. Dorsal fins rather closely approximated, the height of the first being much greater than the disttance between the origins of the two fins; body more or less robust, and strongly compressed; vertebræ few (33 to 37 in genera described).

d^1. RHEOCLINÆ: Dorsal fins very closely approximated, the first without filamentous nor pungent spines; anal fin of moderate length, with 14 to 16 soft rays; belly rather short; fewer than 12 conical gill-rakers on lower limb of first arch; mouth rather large, extending to below eye; lower jaw projecting; teeth on jaws, vomer, and palatines. *Fresh waters of Madagascar* .....3. RHEOCLES.

d^2. MELANOTÆNIINÆ: Dorsal fins usually less closely approximated (but not widely separated), the first spine usually pungent, at least one of the spines always filamentous in the male (except in CENTRATHERINA, in which all of the spines are pungent); anal fin usually elongate; belly more or less shortened. *Fresh waters of Australia, New Guinea, and neighboring islands.*

e^1 Anal fin much elongate, its origin before, or not far behind, that of the first dorsal; first ray of both dorsals and of anal a strong pungent spine (except in RHADINOCENTRUS); body typically very deep and sharply compressed; head depressed, and pointed.

f^1. All of the dorsal spines pungent; jaws and dentition as in CHILATHERINA. *Fresh waters of northern New Guinea*....4. CENTRATHERINA.

f^2. Only the first spine of both dorsals pungent.

g^1. Lower jaw included; gill-rakers few.

h^1. Mouth rather small, with a straight or slightly curved gape; anterior expansion of premaxillaries little developed; teeth of outer mandibular series enlarged.

i^1. Inner band and outer series of teeth in lower jaw not separated by an interspace; outer side of upper jaw with several series of teeth projecting from the thick lip. *Fresh waters of northern New Guinea* .....5. CHILATHERINA.

i^2. Inner band and outer series of teeth in lower jaw separated by an interspace; outer side of upper jaw with few or no teeth. *Fresh waters of New Guinea and Aru.* .....6. ANISOCENTRUS

h^2. Mouth rather large, with a curved gape; premaxillaries with a well developed anterior expansion; series of teeth extending to outer side of jaws; outer series of teeth not enlarged. *Fresh and brackish waters of New Guinea and neighboring islands.* 7. RHOMBOSOMA.

g^2. Jaws equal anteriorly, or the lower slightly projecting; anterior expansion of premaxillaries fitting an emargination in the lower jaw; outer series of teeth in jaws enlarged; teeth also present on vomer and palatines.

j^1. Scales large (32 to 37), with edges nearly or quite entire; gill-rakers of moderate length, 12 to 16 on lower limb of outer arch; teeth in jaws conical. *Fresh and brackish waters of Australia, New Guinea, and neighboring islands*.....8. MELANOTÆNIA.

j^2. Scales small (55 to 60), with edges deeply crenulated; gill-rakers fine and long, 30 on lower limb of outer arch; teeth in jaws stouter and more obtuse. *Fresh waters of northern New Guinea.* 9. GLOSSOLEPIS.

f^3 All of the fin spines flexible; lower jaw projecting; palate apparently toothless; scales large, with edges nearly or quite entire. *Fresh waters of Queensland.* .....10. RHADINOCENTRUS.

e^2. Anal fin less elongate, placed well behind, or nearly opposite, the first dorsal; all of the fin spines flexible; body less robust, approaching that of ATHERINA in form; head formed as in ATHERINA.

k^1. Teeth strong, present on jaws, vomer, palatines, and tongue; spines of dorsal, particularly the first, produced. *Australia.* 11. ATHERINOSOMA.

k^2. Teeth rather small, so far as known restricted to the jaws.

l^1. Lower jaw projecting; second spine of spinous dorsal produced, especially in the male; anal fin short, falcate. *Fresh and brackish waters of Australia, New Guinea, and neighboring islands.* 12. PSEUDOMUGIL.

l^2. Lower jaw included; first spine of spinous dorsal produced; anal fin of moderate length, rounded. *Fresh waters of Celebes.*

3. TELMATHERINA.

c^2. Dorsal fins widely separated, the height of the first being less than the distance between the origins of the two fins; body slender, often not strongly compressed; vertebræ more numerous, so far as described 37 to 56. *Coasts of all tropical and temperate regions, a few genera confined to fresh waters.*

m^1. ATHERININÆ: Premaxillaries not dilated posteriorly, usually slender throughout; gape straight, little restricted at corner of mouth by membrane between jaws (ATHERISCUS *excepted*); anus located far in advance of its normal position immediately before anal fin (scarcely advanced in ATHERION and ISO); belly rather long; ventral fins less posterior in position, their insertions nearer to upper angle of pectoral base than to origin of anal fin; anal fin usually short. *West Indies eastward to the South Sea Islands.*

n^1. Head scaled on sides and top, trunk wholly scaled; body not sharply compressed; belly without a fleshy keel; head not abruptly truncated posteriorly; gill-slits wide; anal fin with 6 to 18 soft rays.

o^1. Anus scarcely advanced in position; rows of sharp tooth-like spines present on head; gill-rakers slender, in moderate number; mouth small, the maxillary not reaching to below eye; rami of mandibles elevated within the mouth. *Shores of the western Pacific.*

14. ATHERION.

o^2. Anus notably advanced in position; no spines on head.

q^1. Gill-rakers slender and numerous (16 to 28 on lower limb of outer arch); mouth larger, the maxillary usually reaching to or beyond front of eye; teeth moderately fine in jaws, seldom lacking on vomer.

r^1. Rami of mandibles not at all or very slightly elevated within the mouth, the upper edge being straight or nearly so; premaxillary processes short and blunt, one-fourth to about one-half as long as the eye; head large and broad; the eye large; the body moderately robust; scales rather large, in 32 to 45 series. *West Indies to the South Sea Islands (more nearly restricted to the Tropics than is* ATHERINA).

15. HEPSETIA.

r^2. Rami of mandibles elevated within the mouth, the upper edge being sharply curved upward posteriorly; premaxillary processes relatively long and slender, about one-half to quite as long as eye; head usually shorter and narrower, and the eye smaller, than in HEPSETIA; the body usually more slender; scales moderate or small, in 40 to 75 series. *West Indies to southern Europe and the South Sea Islands.*

16. ATHERINA.

q^2. Gill-rakers rudimentary, 10 or 12 on lower limb of outer arch; mouth smaller, the maxillary not reaching to front of eye; teeth microscopic in jaws, none on palate; rami of mandibles elevated within the mouth; scales very large, in 25 to 35 series. *Fresh waters of Australia.*

17. (18) CRATEROCEPHALUS.

n^2. Head and adjacent part of trunk naked; body sharply compressed; belly with a fleshy keel; head abruptly truncated posteriorly; the gill-slits behind the first much restricted; anal fin with about 23 soft rays. *Surf along shores of western Pacific and Australia*.....19. Iso.

m^2. ATHERINOPSINÆ: Premaxillaries broadly dilated posteriorly (not greatly dilated in LABIDESTHES and XENATHERINA); gape strongly curved, restricted at corners of mouth by membrane between jaws (except in XENATHERINA); anus normal in position (except in ARCHOMENIDIA); belly short; ventral fins more posterior in position, their insertions being farther from the upper angle of the pectoral base than from the origin of the anal fin, or about midway between these two points; anal fin usually elongate, with from 13 to 29 soft rays. *Shores and streams of the New World.*

s^1. Premaxillaries fully protractile, the skin covering them separated by a deep fold from that of the forehead.

t^1. Sides of head and all of trunk scaled.

u^1. Jaws not produced into a beak; premaxillaries very widely dilated posteriorly; origin of first dorsal behind that of anal only in large-scaled genera.

v^1. Jaws equal, or the lower included at its tip.

w^1. Teeth well developed, in both jaws.

x^1. Scales large, in 36 to 56 series; pectorals reaching to or beyond vertical from insertion of ventrals; small fishes. *Tropical waters of the New World, ranging northward to Nova Scotia and the Gulf of California, southward to Rio de Janeiro and Ecuador.*

y^1. Head not abruptly truncated posteriorly; preopercular ridge without a spine; interorbital flat, or nearly so.

z^1. First dorsal fin beginning before or over origin of anal fin; pectoral fin usually not falcate, and usually shorter than the head; belly rounded transversely; body usually with evenly curved contours; rami of mandibles usually much elevated posteriorly.

aa^1. Scale margins strictly entire, or very slightly crenulate; mandible little oblique, the head not being notably angulated at its base; mouth larger, the maxillary reaching nearly to below front of eye, the length of the mandible before corner of gape being notably greater than that of the pupil; jaws equal.

bb^1. Anus normal in position; air bladder not extended backward over anal base; gape less strongly arched; teeth of jaws in bands, those of the outer premaxillary series not enlarged, directed downward. *Nova Scotia to Louisiana; Gulf of California.*

20. MENIDIA.

Anal fin short, with 15 to 19 soft rays. *Coast and coastwise streams of eastern United States.*

Subgenus ISCHNOMEMBRAS.

Anal fin longer, with 20 to 29 soft rays. *Nova Scotia to Louisiana; Gulf of California.*

Subgenus MENIDIA.

*bb*². Anus advanced in position, as in ATHERINA; air bladder extended backward to beyond middle of anal base; gape very strongly arched; teeth of jaws in two series, those of the outer premaxillary series enlarged and directed forward more than downward. *Streams of east central Mexico.* 21. ARCHOMENIDIA.

*aa*². Scale margins strongly crenate or roughly laciniate; mandible oblique, the outline of head angulated at its base; mouth very small, the maxillary not nearly reaching to below front of eye, and the length of mandible before corner of gape being only about as long as the pupil; lower jaw included; air bladder not extended into urosome.

*cc*¹. Head not compressed, its width being equal to its depth; body more nearly terete, the belly very broadly rounded; base of spinous dorsal in front of vertical from origin of anal; dorsal and anal fins wholly naked, the scales of the body fitting tightly against the base of the rays; scales thinner, with well developed apical radii, scale margins crenulate or more evenly laciniate. *Tropical Pacific.* 22. HUBBESIA.

*cc*². Head and body strongly compressed; base of spinous dorsal entirely or in part over front of anal; dorsal and anal fins with a sheath of large deciduous scales; scales thicker, with the apical radii obsolete, and the margins coarsely and irregularly laciniate. *Tropical Atlantic, north to New York* ..... 23. MEMBRAS.

*z*². First dorsal fin beginning notably behind origin of anal; pectoral fin falcate, usually longer than the head; belly more or less sharply compressed, as though pinched between thumb and finger; body of peculiar form, the anterodorsal and posteroventral, and the posterodorsal and anteroventral contours, respectively, being nearly parallel; air bladder broadly extended backward into tail over first fourth or third of anal base; mandible oblique, the outline of the head angulated at its base.

*dd*¹. Scale margins entire, or in part weakly and coarsely crenate, the apical circuli obsolete; belly shortened, the origin of the anal fin being nearer to the head than to the base of caudal; end of second dorsal a little in advance of that of anal; rami of mandibles little elevated posteriorly (except in T. SARDINA). *Western Mexico and Central America to Colombia and Brazil* ..... 24. THYRINA.

*dd*². Scale margins all finely laciniate, produced outward between the ends of the well developed apical radii; origin of anal fin midway between head and base of

caudal; end of second dorsal over that of anal; rami of mandibles elevated posteriorly. *Shores of tropical Pacific* .....25. THYRINOPS.

*dd*³. Scale margins all sharply and strongly dentate; apical radii obsolete; belly longer, the origin of the anal fin being nearer caudal base than head; end of short second dorsal well behind that of anal; rami of mandibles highly elevated posteriorly; the ventral compression of the body carried to the extreme, the belly forming a keel both before and behind ventrals. *Shores of the tropical Pacific*.....26. ATHERINELLA.

*y*². Head truncated posteriorly, the opercle short; preopercular ridge with a weak flat spine at angle; interorbital convex; head and body sharply compressed, especially ventrally; rami of mandibles scarcely elevated posteriorly; silvery lateral band very wide. *Shores of the tropical Pacific.* 27. EURYSTOLE.

*x*². Scales of small or moderate size, in 48 to 105 series; pectoral fins usually not reaching to vertical from insertion of ventral; fishes of larger size. *Temperate waters of South America, ranging northward to southeastern Brazil and to Peru.*

*ee*¹. Body of the form, and with the sharply compressed belly, of THYRINA; scales in 53 series, their margins laciniate; teeth lacking on vomer, in two series on jaws; first dorsal anterior to anal; pectorals reaching to vertical from insertion of ventrals. *Southeastern Brazil in fresh water.* 28. PSEUDOTHYRINA.

*ee*². Body of the form, and with the rounded belly, of MENIDIA; pectorals not reaching to ventrals.

*ff*¹. Scale margins sublaciniate; teeth well developed on the vomer, in bands on jaws; first dorsal inserted over anus. *Southeastern Brazil, in fresh water.* 29. KRONIA.

*ff*². Scale margins entire, so far as known.

*gg*¹. Head pike-like, sharply pointed; belly greatly lengthened, the dorsal and anal fins located posteriorly; first dorsal base over origin of anal; teeth well developed on vomer; scales in about 50 to 70 series. *Argentina*.....30. ODONTESTHES.

*gg*². Head formed as in MENIDIA; belly less lengthened, the dorsal and anal fins less posterior; first dorsal base over interspace between insertion of ventral and origin of anal; teeth usually lacking on vomer; scales usually finer. *Shores and streams of Argentina, Peru, and Chile*.....31. AUSTROMENIDIA.

*w*². Teeth obsolete, or microscopic and deciduous; scales small, in about 70 series, their margins serrulate; lower jaw deep at base; first dorsal fin over front of anal. *Shores of California and the outer coast of Lower California*.....33. LEURESTHES

v^2. Jaws unequal, the lower more or less projecting (except in C. PROMELAS, in which the premaxillaries are secondarily produced forward); rami of mandibles more or less elevated posteriorly; scales large or moderately fine in 37 to about 75 series, their margins entire or crenate; first dorsal fin beginning over or before orgin of anal; a conical diverticulum of the air bladder extended backward over one-third to two-thirds of the anal base. *Lakes and streams of the Rio Lerma System and lakes of Mexico*.....32. CHIROSTOMA.

u^2. Jaws produced into a short rounded beak; premaxillaries dilated, but proportionately less widely than in the preceding genera of the subfamily; origin of first dorsal behind that of anal; scales small, in about 75 series, their margins entire; air bladder extended backward a short distance into tail; rami of mandibles scarcely elevated posteriorly, nearly linear in form. *Fresh waters of eastern United States*.....34. LABIDESTHES.

t^2. Scales lacking on head and most of trunk; jaws pointed anteriorly, the premaxillaries rather narrowly dilated posteriorly; gape wide, not restricted by membrane between jaws; rami of mandibles sublinear; belly short; anus in normal position; air bladder broadly extended backward into tail over front of anal base; first dorsal base behind origin of anal; scales of moderate size, their margins more or less evidently crenate. *Streams of east central Mexico.*

35. XENATHERINA.

s^2. Premaxillaries not technically protractile, the skin above continuous with that of the forehead; a cross furrow at base of premaxillary processes permitting a degree of motion; rami of mandibles elevated posteriorly; scales moderately small or fine; size rather large, comparatively. *Shores and streams of the Pacific slope of America.*

hh^1. Scales on top of head not reversed in imbrication, those of the body larger, in 47 to about 80 series; vomer without teeth; anal fin long, with 17 to 24, usually 20 to 23, soft rays; spinous dorsal well developed. *Western shores of North America.*

ii^1. Teeth of jaws simple, conic, in bands; first dorsal of seven to nine spines. *Shores of California, and the outer coast of Lower California*.....36. ATHERINOPSIS.

ii^2. Teeth of jaws forked, uniserial; first dorsal of four to seven spines. *Oregon to the Gulf of California.*

jj^1. Head slightly depressed; gill-rakers 16 to 18 on lower limb of outer arch, strongly compressed, curved, serrate on inner margins, about one-fourth as long as eye; inner fork of teeth usually much the shorter. *Gulf of California.*

37. COLPICHTHYS.

jj^2. Head compressed; gill-rakers 20 to 25 on lower limb of outer arch, slender, terete, straight, nearly smooth, about two-fifths as long as eye; inner fork of teeth usually little the shorter. *Outer coast of Lower California, California and Oregon.*

38. ATHERINOPS.

hh^2. Scales on top of head reversed in imbrication, those of the body smaller, in about 75 to 100 series; vomer with teeth; anal fin shorter, with 13 to 16 soft rays. *Western shores and coastwise streams of South America.*

kk[1]. First dorsal fin reduced in size and composed of one to six spines, occasionally altogether wanting; scales 75 to 80. *Andean streams (and shores?) of the Pacific slope of Peru and Chile.*
39. BASILICHTHYS.

ANNOTATED LIST OF THE GENERA AND SPECIES OF ATHERINE FISHES

On the following pages we list the genera of the ATHERINIDÆ, with notes and descriptions, in the order in which we have differentiated them in the foregoing key. Under the head of each genus we list all of the species which we recognize, with synonomy, and frequently with notes and descriptions. The species examined by us in the preparation of this report are marked [St.]. The accompanying plates are nearly all electrotypes from those accompanying the original description. For most of these we are indebted to the kindly aid of Dr. Marcus Benjamin, editor of the *Proceedings of the United States National Museum*. The electrotypes of the species described by Dr. Seth E. Meek are loaned by the Field Museum.

Subfamily NANNATHERININÆ

I. NANNATHERINA Regan, 1906.

NANNATHERINA Regan, *Ann. Mag. Nat. Hist.* (7), **18**, 451, 1906.
Orthotype.—NANNATHERINA BALSTONI Regan.
Range.—Western Australia, in fresh water.

The characters and relationships of this peculiarly perch-like type have already been discussed (pp. 8, 9). According to Regan, "the vertebral column and pectoral arch are as in typical ATHERINIDÆ; the pelvic bones are quite remote from the clavicles, to which they are connected by ligament."

The possibility of real relationship of NANNATHERINA with NANNOPERCA, another fresh-water fish of Australia, is suggested by the external features of the two types. NANNOPERCA is currently regarded as related to KUHLIA. It is possible that NANNATHERINA should be regarded as the type of a distinct family.

1. Nannatherina balstoni Regan, 1906.

NANNATHERINA BALSTONI Regan, *Ann. Mag. Nat. Hist.*, (7), **18**, 451, 1906.
Type-locality.—King River, Western Australia.
Range.—King River, Western Australia.

Subfamily BEDOTIINÆ.

II. BEDOTIA Regan, 1903.

BEDOTIA Regan, *Rev. Suisse Zool.*, **11**, 416, 1903.
Orthotype.—BEDOTIA MADAGASCARENSIS Regan.
Range.—Fresh waters of Madagascar.

A highly aberrant genus, with three known species.

2. **Bedotia madagascarensis** Regan, 1903.

BEDOTIA MADAGASCARENSIS Regan, *Rev. Suisse Zool.*, **11**, 416, pl. 14, fig. 2, 1903.
BOULENGER, *Catalogue Fresh-water Fishes Africa*, **4**, 76, 1916.
Type-locality.—Fresh waters of Madagascar.
Range.—Fresh waters of Madagascar.

3. **Bedotia longianalis** Pellegrin, 1914.

BEDOTIA LONGIANALIS Pellegrin, *Bull. Soc. Zool. France*, **39**, 178, 1914.
Type-locality.—Mahambo, on the east coast of Madagascar.
Range.—Madagascar, probably in fresh or brackish water.

4. **Bedotia geayi** Pellegrin, 1907.

BEDOTIA GEAYI Pellegrin, *Bull. Mus. Hist. Nat. Paris*, **13**, 205, 1907; *Bull Soc. Nat. Ac. France*, **55**, 55, 1908.
Type-locality.—A tributary of the Bas-Mananjary, Madagascar.
Range.—Fresh waters of Madagascar.

Subfamily RHEOCLINÆ.

III. **RHEOCLES** Jordan and Hubbs, 1919.

RHEOCLES Jordan and Hubbs, *Proc. Acad. Nat. Sci. Phila.*, 1919, 343.
Orthotype.—ELEOTRIS SIKORÆ Sauvage.
Range.—Fresh waters of Madagascar.

Dorsal fins closely approximated, the spines of the first dorsal all flexible, none produced as filaments; anal fin of moderate length, composed of one spine and 14 to 16 soft rays; pectoral fins high, the ventrals not far behind them; caudal emarginate. Premaxillaries protractile, without an anterolateral notch; fewer than 12 conical gill-rakers on lower limb of first arch.

This well-marked genus bears considerable resemblance to BEDOTIA of the same region, and to the MELANOTÆNIINÆ of the Australian fauna.

5. **Rheocles sikoræ** (Sauvage), 1891.

ELEOTRIS SIKORÆ Sauvage, *Hist. Madag., Poiss.*, 521, pl. 44 C, fig. 2, 1891.
ATHERINA SIKORÆ Boulenger, *Zool. Rec.*, 20, 1891; *Catalogue Fresh-water Fishes Africa*, **4**, 76, 1916.
Type-locality.—Streams of the eastern slope of the central range of Madagascar.
Range.—Fresh waters of eastern Madagascar.

6. **Rheocles alaotrensis** (Pellegrin), 1914.

ATHERINA ALAOTRENSIS Pellegrin, *Bull. Soc. Zool. France*, **39**, 46, 1914; Boulenger, *Catalogue Fresh-water Fishes Africa*, **4**, 76, 1916.
Type-locality.—Lake Alaotra, Madagascar.
Range.—Lake Alaotra, in eastern Madagascar.

ATHERINA ALAOTRENSIS Pellegrin is apparently congeneric with ELEOTRIS SIKORÆ Sauvage, but it has a smaller mouth, fewer dorsal rays, and is described as having the belly naked behind the ventrals, whereas this region is figured as scaled in SIKORÆ.

Subfamily MELANOTÆNIINÆ.

PSEUDOMUGILIDÆ Kner, *Reise Novara, Fische,* 275, 1865; Kner and Steindachner, *Sitzb. Akad. Wiss. Wien,* **44,** 372, 1866.

ZANTECLIDÆ Castelnau, *Proc. Zool. Soc. Victoria,* **2,** 88, 1873.

NEOATHERINIDÆ Castelnau, *Researches Fishes, Australia,* 31, 1875.

MELANOTÆNIINÆ Gill, *Am. Nat.,* 708, 1894; Weber, *Nova Guinea,* 230, 1908.

MELANOTÆNIIDÆ Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 120, 1896.

We adopt the name MELANOTÆNIINÆ for this group, for the following reasons: ZANTECLA and NEOATHERINA are regarded as identical with MELANOTÆNIA. The name PSEUDOMUGILIDÆ was not defined and had not been used in the subpatronymic form, and PSEUDOMUGIL, furthermore, is not typical of the group as a whole. In fact Regan has urged that PSEUDOMUGIL be removed from the MELANOTÆNIA group, suggesting that its relationships are rather with TELMATHERINA. As both of these genera, however, have more in common with the typical MELANOTÆNIINÆ than with other groups of the ATHERINIDÆ, we place them in that subfamily.

We include in the MELANOTÆNIINÆ nine genera from the warmer parts of Australia, and from New Guinea and neighboring islands, with one genus (TELMATHERINA) from Celebes. All, or at least most of them, live exclusively in fresh waters. Most of the genera agree in having a strong pungent spine at the front of both dorsals, and at the front of the anal fin, which is usually elongate, and begins in advance of the first dorsal. In MELANOTÆNIA and RHOMBOSOMA the anal sometimes begins definitely behind the front of the first dorsal, as also in ATHERINOSOMA, PSEUDOMUGIL, and TELMATHERINA, genera in which the anal is rather short or moderately elongate. In these three genera, as well as in RHADINOCENTRUS among the more typical MELANOTÆNIINÆ, all of the fin spines are flexible. In CENTRATHERINA all of the dorsal spines are pungent In all of the other genera, one, two, or all of the dorsal spines are filamentous, especially in the male. Sexual dimorphism in the ATHERINIDÆ appears to be restricted to the MELANOTÆNIINÆ.

IV. CENTRATHERINA Regan, 1914.

CENTRATHERINA Regan, *Trans. Zool. Soc. London,* **20,** 283, 1914.

Orthotype.—RHOMBATRACTUS CRASSISPINOSUS Weber.

Range.—Fresh waters of northern New Guinea.

Mr. Regan (*l. c.*, p. 278) has assumed that the spines have become secondarily pungent in this genus. It seems more plausible to us, however, that they are all primitively robust, as in the perch-like genus NANNATHERINA and in NANNOPERCA.

7. Centratherina crassispinosa (Weber), 1913.

RHOMBATRACTUS CRASSISPINOSUS Weber, *Nova Guinea*, **9**, 567, 1913.
CENTRATHERINA CRASSISPINOSA Regan, *Trans. Zool. Soc. London*, **20**, 283, pl. 31, fig. 2, 1914.
Type-locality.—Northern New Guinea: "Unterlauf, Oberlauf und Nebenfluss Buarin des Sermowai-Flusses bei der Walckenaer-Bucht."
Range.—Fresh waters of northern New Guinea.

V. CHILATHERINA Regan, 1914.

CHILATHERINA Regan, *Trans. Zool. Soc. London*, **20**, 282, 1914.
Logotype (now definitely designated).—RHOMBATRACTUS FASCIATUS Weber.
Range.—Fresh waters of northern New Guinea.

8. Chilatherina fasciata (Weber), 1913.

RHOMBATRACTUS FASCIATUS Weber, *Nova Guinea*, **9**, 565, 1913.
CHILATHERINA FASCIATUS Regan, *Trans. Zool. Soc. London*, **20**, 282, pl. 31, fig. 4, 1914.
Type-locality.—Mouth of the Sermowai River, New Guinea.
Range.—Streams of northern New Guinea.

9. Chilatherina sentaniensis (Weber), 1908.

RHOMBATRACTUS SENTANIENSIS Weber, *Nova Guinea*, **5**, 235, pl. 11, fig. 3, 1908; **9**, 564, 1913.
CHILATHERINA SENTANIENSIS Regan, *Trans. Zool. Soc. London*, **20**, 282, 1914.
Type-locality.—Lake Sentani, New Guinea.
Range.—Lake Sentani, northern New Guinea.

VI. ANISOCENTRUS Regan, 1914.

ANISOCENTRUS Regan, *Trans. Zool. Soc. London*, **20**, 281, 1914.
Orthotype.—NEMATOCENTRIS RUBROSTRIATUS Ramsay and Ogilby.
Range.—Southern New Guinea and Aru Islands, in fresh water.

10. Anisocentrus rubrostriatus (Ramsay and Ogilby), 1867.

NEMATOCENTRIS RUBROSTRIATUS Ramsay and Ogilby, *Proc. Linn. Soc. N. S. Wales* (21), **1**, 14, 1886 (1887); Regan, *Proc. Zool. Soc. London*, 339, 1914.
RHOMBATRACTUS RUBROSTRIATUS Ogilby, *Proc. Linn. Soc. N. S. Wales*, **21**, 134, 1896.
ANISOCENTRUS RUBROSTRIATUS Regan, *Trans. Zool. Soc. London*, **20**, 281, pl. 31, fig. 3, 1914.
Type-locality.—Strickland River, New Guinea.
MELANOTÆNIA DUMASI Weber, *Nova Guinea*, **5**, 240, pl. 11, fig. 1, 1908; **9**, 558, 1913.
Type-locality.—River Wa Udu, basin of the Urama, southern New Guinea.
Range.—Streams of southern New Guinea and Aru Islands.

VII. RHOMBOSOMA Regan, 1914.

RHOMBOSOMA Regan, *Trans. Zool. Soc. London,* **20,** 283, 1914.
Orthotype.—NEMATOCENTRIS NOVÆ-GUINEÆ Ramsay and Ogilby.
Range.—Fresh and brackish waters of New Guinea and neighboring islands.

This genus, as well as others proposed by Regan at the same time, is very closely related to MELANOTÆNIA, differing from that genus in details of mouth structure and dentition. It may be found convenient to reunite some of these groups with MELANOTÆNIA. We retain them all, however, awaiting the fresh evidence of newly described or rediscovered species.

Mr. Regan recognized but two species of RHOMBOSOMA after examining a large series of specimens, including paratypes of most of the nominal species.

11. Rhombosoma goldiei (Macleay), 1884.

ARISTEUS GOLDIEI Macleay, *Proc. Linn. Soc. N. S. Wales,* **8,** 269, 1883 (1884); Perugia, *Ann. Mus. Genova,* **34,** 548, 1894.
RHOMBATRACTUS GOLDIEI Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 134, 1896.
RHOMBOSOMA GOLDIEI Regan, *Proc. Zool. Soc. London,* 339, figs. 1–2, 1914.
Type-locality.—Goldie River, New Guinea.
NEMATOCENTRIS NOVÆ-GUINEÆ Ramsay and Ogilby, *Proc. Linn. Soc. N. S. Wales* (2) **1,** 13, 1886 (1887).
RHOMBATRACTUS NOVÆ-GUINEÆ Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 134, 1896.
RHOMBOSOMA NOVÆ-GUINEÆ Regan, *Trans. Zool. Soc. London,* **20,** 283, pl. 31, figs. 5–6, 1914; *Proc. Zool. Soc. London,* 339, 1914.
Type-locality.—Strickland River, New Guinea.
RHOMBATRACTUS AFFINIS Weber, Nova Guinea, **5,** 234, pl. 11, fig. 5, 1908; **9,** 565, 1913; Regan, *Trans. Zool. Soc. London,* **20,** 284, 1914.
Type-locality.—New Guinea: "Timena, Bach der in den Sentani-See mündet; Süsswasser."
RHOMBATRACTUS KOCHII Weber, *Nova Guinea,* **5,** 237, pl. 11, fig. 6, 1908; **9,** 562, 1913; Regan, *Trans. Zool. Soc. London,* **20,** 284, 1914.
Type-locality.—Southern New Guinea: "Wasserläufe, die in die Münding des Merauke-Flusses ausmünden; vermutlich Brackwasser."
RHOMBATRACTUS WEBERI Regan, *Ann. Mag. Nat. Hist.* (8), **1,** 155, 1908; *Trans. Zool. Soc. London,* **20,** 284, 1914.
Type-locality.—Fly River, New Guinea.
RHOMBATRACTUS CATHERINÆ De Beaufort, *Zool. Anz.,* **36,** 250, 1910; *Bijd. Dierk. Amsterdam,* 106, pl. 2, fig. 1, 1913; Regan, *Trans. Zool. Soc. London,* **20,** 284, 1914.
Type-locality.—Brook flowing into the Rabiai River, Waigiou.
RHOMBATRACTUS SENCKENBERGIANUS Weber, *Abh. Senckenb. Nat. Ges.,* **34,** 25, pl. 1, fig. 2, 1911; Regan, *Trans. Zool. Soc. London,* **20,** 284, 1914.
Type-locality.—Terangan Island, Aru Islands; in fresh water.
Range.—Fresh and brackish waters of New Guinea, the Aru Islands, and Waigiou.

12. Rhombosoma lorentzii (Weber), 1908.

RHOMBATRACTUS LORENTZII Weber, *Nova Guinea,* **5,** 236, pl. 11, fig. 2, 1908; **9,** 564, 1913.

RHOMBOSOMA LORENTZII Regan, *Trans. Zool. Soc. London,* **20,** 284, 1914.

Type-locality.—Tawarin River, northern New Guinea.

Range.—Fresh waters of northern New Guinea.

In respect to the length of the anal fin, this species is the most aberrant of the MELANOTÆNIINÆ.

VIII. MELANOTÆNIA Gill, 1862.

MELANOTÆNIA Gill, *Proc. Acad. Nat. Sci. Phila.,* 280, 1862; Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 130, 1896; Weber, *Nova Guinea,* **5,** 238, 1908; Regan, *Trans. Zool. Soc. London,* **20,** 270, 1914.

Orthotype.—ATHERINA NIGRANS Richardson.

STRABO Kner and Steindachner, *Sitzb. Akad. Wiss. Wien,* **44,** 372, 1866.

Orthotype.—STRABO NIGROFASCIATUS Kner and Steindachner.

NEMATOCENTRIS Peters, *Monatsb. Akad. Wiss. Berlin,* 516, 1866 (1867).

Haplotype.—NEMATOCENTRIS SPLENDIDA Peters.

ZANTECLA Castelnau, *Proc. Zool. Soc. Victoria,* **2,** 88, 1873.

Orthotype.—ZANTECLA PUSILLA Castelnau.

AIDA Castelnau, *Researches Fishes Australia,* 10, 1875; Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 128, 1896.

Orthotype.—AIDA INORNATA Castelnau.

NEOATHERINA Castelnau, *Researches Fishes Australia,* 31, 1875; Macleay, *Proc. Linn. Soc. N. S. Wales,* **6,** 46, 1881 (1882); Ogilby, *ibid.,* **21,** 121, 1896.

Orthotype.—NEOATHERINA AUSTRALIS Castelnau.

ARISTEUS Castelnau, *Proc. Linn. Soc. N. S. Wales,* **3,** 141, 1878 (1879).

Orthotype.—ARISTEUS FITZROYENSIS Castelnau.

RHOMBATRACTUS Gill, *Amer. Nat.,* 709, 1894; Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 124, 1896 (substitute for ARISTEUS preoccupied).

Orthotype.—ARISTEUS FITZROYENSIS Castelnau.

Range.—Warmer parts of Australia, New Guinea, and the neighboring islands; in fresh and brackish water, and (in the opinion of Mr. Regan) probably also in the sea.

According to Mr. Regan, the many nominal Australian species of the MELANOTÆNIINÆ, for which eight generic names have been proposed, are all reducible to one, MELANOTÆNIA NIGRANS (Richardson). Regarding this situation Mr. Allan R. McCulloch remarks (*in lit.*): "Surprising as Regan's treatment of our MELANOTÆNIINÆ was, it harmonized with my own ideas on the subject very well. Our climatic conditions and intercalating river systems are peculiarly uniform, and we are finding that the fishes inhabiting them may extend over a very wide portion of the continent, varying greatly, but not so that they can be conveniently subdivided into geographical species or even subspecies."

Not having sufficient material with which to determine whether any

of the numerous synonyms ascribed by Regan to MELANOTÆNIA NIGRANS might be valid species, we follow his decisions. To the synonyms which he adopted, we add ATHERINICHTHYS DUBOULAYI Castelnau, and RHOMBATRACTUS MACCULLOCHI Ogilby.

13. Melanotænia nigrans (Richardson), 1943.*St.*

ATHERINA NIGRANS Richardson, *Ann. Mag. Nat. Hist.*, **11**, 180, 1843.

ATHERINICHTHYS NIGRANS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 406, 1861; *Ann. Mag. Nat. Hist.* (4), **17**, 396, 1876.

NEMATOCENTRIS NIGRA Günther, *Ann. Mag. Nat. Hist.* (3), **20**, 65, 1867.

NEMATOCENTRIS NIGRANS Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 44, 1881 (1882).

MELANOTÆNIA NIGRANS Ogilby, *Proc. Linn. Soc. N. S. Wales*, **21**, 131, 1896; Regan, *Trans. Zool. Soc. London*, **20**, 279, 1914.

Type-locality.—King's River, near Victoria, Australia.

STRABO NIGROFASCIATUS Kner and Steindachner, *Sitzb. Akad. Wiss. Wien*, **44**, 373, 395, pl. 3, fig. 10; **45**, 16, 1867.

MELANOTÆNIA NIGROFASCIATA Ogilby, *Proc. Linn. Soc. N. S. Wales*, **21**, 135, 1896.

Type-locality.—Brisbane, Australia.

NEMATOCENTRIS SPLENDIDA Peters, *Monatsb. Akad. Wiss. Berlin*, 516, 1866 (1867).

MELANOTÆNIA SPLENDIDA Ogilby, *Proc. Linn. Soc. N. S. Wales*, **21**, 134, 1896.

Type-locality.—Fitzroy River, Queensland.

ZANTECLA PUSILLA Castelnau, *Proc. Zool. Soc. Victoria*, **2**, 88, 1873; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 44, 1881 (1882).

MELANOTÆNIA PUSILLA Ogilby, *Proc. Linn. Soc. N. S. Wales*, **21**, 135, 1896.

Type-locality.—Port Darwin, North Australia.

AIDA INORNATA Castelnau, *Researches Fishes Australia*, 10, 1875; Macleay, *Proc. Linn. Soc. N. S. Wales*, **5**, 349, 1880 (1881); Ogilby, *ibid.*, **21**, 128, 1896.

Type-locality.—Gulf of Carpenteria, Australia.

NEOATHERINA AUSTRALIS Castelnau,[11] *Researches Fishes Australia*, 32, 1875; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 46, 1881 (1882); Ogilby, *ibid.*, **21**, 122, 1896; Zietz, *Proc. Roy. Soc. S. Austral.*, **33**, 264, 1909.

Type-locality.—Swan River, Western Australia.

ARISTEUS FITZROYENSIS Castelnau, *Proc. Linn. Soc. N. S. Wales*, **3**, 141, 1878 (1879); Macleay, *ibid.*, **5**, 625, 1881.

RHOMBATRACTUS FITZROYENSIS Ogilby, *Proc. Linn. Soc. N. S. Wales*, **21**, 125, 1896.

RHOMBATRACTUS FITZROYENSIS Cockerell, *Mem. Queensl. Mus.*, **3**, 38, 1915.

Type-locality.—Rockhampton, Fitzroy River, Queensland.

ARISTEUS FLUVIATILIS Castelnau, *Proc. Linn. Soc. N. S. Wales*, **3**, 141, 1878 (1879); Macleay, *ibid.*, **5**, 625, 1881.

RHOMBATRACTUS FLUVIATILIS Ogilby, *Proc. Linn. Soc. N. S. Wales*, **21**, 125, 1896.

Type-locality.—Murrumbridgee River, New South Wales (so fixed by Ogilby).

ATHERINICHTHYS DUBOULAYI Castelnau, *Proc. Linn. Soc. N. S. Wales*, **3**, 143, 1878 (1879).

[11] Only the notoriously inaccurate character of Castelnau's descriptions justifies one in including NEOATHERINA AUSTRALIS in synonymy of MELANOTÆNIA NIGRANS.

CHIROSTOMA DUBOULAYI Waite, *Mem. N. S. Wales Nat. Club,* **2,** 21, 1904.

Type-locality.—Lagoon of fresh water connected with the Richmond River, Australia.

ARISTEUS RUFESCENS Macleay, *Proc. Linn. Soc. N. S. Wales,* **5,** 625, 1881.

RHOMBATRACTUS RUFESCENS Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 133, 1896.

Type-locality.—Rivers of northern Queensland.

ARISTEUS LINEATUS Macleay, *Proc. Linn. Soc. N. S. Wales,* **5,** 626, 1881.

RHOMBATRACTUS LINEATUS Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 133, 1896.

Type-locality.—Richmond River, New South Wales.

ARISTEUS CAVIFRONS Macleay, *Proc. Linn. Soc. N. S. Wales,* **7,** 70, 1882 (1883).

RHOMBATRACTUS CAVIFRONS Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 133, 1896.

Type-locality.—Palmer River, in northern Queensland.

ARISTEUS PERPOROSUS De Vis, *Proc. Linn. Soc. N. S. Wales,* **9,** 694, 1884 (1885).

RHOMBATRACTUS PERPOROSUS Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 134, 1896.

Type-locality.—Maryborough, Australia.

ARISTEUS LORIÆ Perugia, *Ann. Mus. Genova,* **34,** 549, 1894.

RHOMBATRACTUS LORIÆ Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 134, 1896.

Type-locality.—Inawi, British New Guinea.

NEMATOCENTRIS TATEI Zietz, *Rept. Horn Sci. Exp. Centr. Austral.,* **6,** 178, fig. 2, 1896.

RHOMBATRACTUS TATEI Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 134, 189; Zietz, *Proc. Roy. Soc. S. Austral.,* **33,** 264, 1909.

Type-locality.—Horseshoe Bend, Finke River, Australia (now definitely restricted).

NEMATOCENTRIS WINNECKEI Zietz, *Rept. Horn Sci. Exp. Centr. Austral.,* **2,** 179, fig. 3, 1896.

RHOMBATRACTUS WINNECKEI Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 134, 1896; Zietz, *Proc. Roy. Soc. S. Austral.,* **33,** 264, 1909.

Type-locality.—Near Horseshoe Bend, Finke River, Australia.

MELANOTÆNIA MACULATA Weber, *Nova Guinea,* **5,** 239, pl. 11, fig. 4 1908; **9,** 557, 1913.

Type-locality.—"Aus dem Mündungsgebiet des Meranke-Flusses, Süd-New Guinea; vermuthlich schwach brackisches Wasser."

MELANOTÆNIA OGILBYI Weber, *Notes Leyden Mus.,* **32,** 230, 1910; *Nova Guinea,* **9,** 560, fig. 28, 1913.

Type-locality.—Tümpel, Lorentz River, New Guinea.

RHOMBATRACTUS PATOTI Weber, *Abh. Senckenb. Nat. Ges.,* **34,** 26, pl. 1, fig. 3, 1911.

Type-locality.—Terangan.

RHOMBATRACTUS MACCULLOCHI (Ogilby) Cockerell, *Mem. Queensl. Mus.,* **3,** 38, 1915.

Type-locality.—Barron R., North Queensland.

MELANOTÆNIA MACCULLOCHI Ogilby, *Mem. Queensl. Mus.,* **3,** 118, pl. 29, fig. 1, 1915.

Range.—Warmer parts of Australia, New Guinea, and the neighboring islands; in fresh and brackish water, and perhaps in the sea.

IX. GLOSSOLEPIS Weber, 1907.

GLOSSOLEPIS Weber, *Nova Guinea,* **5,** 241, 1908; Regan, *Trans. Zool. Soc. London,* **20,** 281, 1914.

Orthotype.—GLOSSOLEPIS INCISUS Weber.

Range.—Fresh waters of northern New Guinea.

14. Glossolepis incisus Weber, 1908.

GLOSSOLEPIS INCISUS Weber, *Nova Guinea,* **5,** 241, pl. 11, fig. 7, 1908; **9,** 562, 1913; Regan, *Trans. Zool. Soc. London,* **20,** 281, 1914.
Type-locality.—Lake Sentani, northern New Guinea.
Range.—Lake Sentani, New Guinea.

X. RHADINOCENTRUS Regan.

RHADINOCENTRUS Regan, *Trans. Zool. Soc. London,* **20,** 280, 1914.
Orthotype.—RHADINOCENTRUS ORNATUS Regan.
Range.—Fresh waters of Queensland.

In the lack of pungent spines in the fins, and in other characters, the genus RHADINOCENTRUS approaches the three which follow, ATHERINOSOMA, PSEUDOMUGIL, and TELMATHERINA. This and related genera differ from these three in much the same manner that THYRINA differs from MENIDIA; the belly is shortened, the anal fin elongate, with the origin anterior.

15. Rhadinocentrus ornatus Regan, 1914.

RHADINOCENTRUS ORNATUS Regan, *Trans. Zool. Soc. London,* **20,** 280, pl. 31, fig. 1, 1914; Cockerell, *Mem. Queensl. Mus.,* **3,** 38, 1915; Ogilby, *Mem. Queensl. Mus.,* **6,** 99, 1918.
Type-locality.—A pond on Moreton Island, near Brisbane, Queensland.
Range.—Fresh waters of Moreton Island, Queensland.

XI. ATHERINOSOMA Castelnau, 1875.

ATHERINOSOMA Castelnau, *Researches Fishes Australia,* 138, 1875; Macleay, *Proc. Linn. Soc. N. S. Wales,* **6,** 45, 1881 (1882); **9,** 171, 1884 (1885).
Haplotype.—ATHERINOSOMA VORAX Castelnau.
Range.—Australia; probably confined to fresh water.

ATHERINOSOMA has teeth on the jaws and vomer, and according to the type description, there are also teeth, strong and hooked, on the palatine and tongue. The body is moderately elongate; the first dorsal inserted well forward, its spines filamentous; the anal short; the scales very large, as in PSEUDOMUGIL.

This genus is imperfectly known, but the discovery and description of a second species seem to indicate that the genus is valid and that its relationships are closest with PSEUDOMUGIL.

16. Atherinosoma vorax Castelnau, 1872.

ATHERINOSOMA VORAX, Castelnau, *Proc. Zool. Soc. Victoria,* **1,** 138, 1872; *Macleay, Proc. Linn. Soc. N. S. Wales,* **6,** 45, 1881 (1882).
Type-locality.—Cape Schanck, Australia.
Range.—Region of Cape Schanck, Australia; perhaps in fresh water.

17. Atherinosoma jamesonii Macleay, 1885.

ATHERINOSOMA JAMESONII Macleay, *Proc. Linn. Soc. N. S. Wales,* **9,** 171, 1884 (1885).
Type-locality.—Bremer River, a tributary of the Brisbane; fresh water.
Range.—Brisbane River basin, Australia.

XII. PSEUDOMUGIL Kner, 1865.

PSEUDOMUGIL Kner, *Reise Novara, Fische,* 275, 1865; Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 123, 1896.
Orthotype.—PSEUDOMUGIL SIGNIFER Kner.
Range.—Fresh and brackish waters of New Guinea, the Aru Islands, and of the warmer parts of Australia.

This genus includes perhaps the smallest of all the ATHERINIDÆ. The type is the dainty "Blue-eye," valued in the aquarium.

18. Pseudomugil signifer Kner, 1865.*St.*

PSEUDOMUGIL SIGNIFER Kner, *Reise Novara, Fische,* 275, pl. 13, fig. 5, 1865; Ogilby, *Proc. Linn. Soc. N. S. Wales,* **21,** 123, 1896; **22,** 82, 1897; Stead, *Fishes of Australia,* 71, 1906.
Type-locality.—Sidney, Australia.
Range.—Fresh and brackish waters of eastern Australia.

Specimens of this species from George's River, New South Wales, were examined by the writers.

19. Pseudomugil signatus (Günther), 1867.

ATHERINA SIGNATA Günther, *Ann. Mag. Nat. Hist.* (3), **20,** 64, 1867; Macleay, *Proc. Linn. Soc. N. S. Wales,* **6,** 40, 1881 (1882).
Type-locality.—Cape York, Australia.
Range.—Cape York, Australia.

As described, this species appears to differ from P. SIGNIFER in having fewer dorsal rays, and in the filamentous production of all the unpaired fins and the ventrals, a character perhaps of the males. It has been considered identical with P. SIGNIFER.

20. Pseudomugil novæ-guineæ Weber, 1908.

PSEUDOMUGIL NOVÆ-GUINEÆ Weber, *Nova Guinea,* **5,** 232, pl. 13, fig. 5, 1908; *Abh. Senckenb. Nat. Ges.,* **34,** 25, 1911; *Nova Guinea,* **9,** 556, fig. 27, 1913.
Type-locality.—Fresh water of the Wagani River, Urama Basin, south coast of New Guinea.
Range.—Streams of southern New Guinea.

21. Pseudomugil gertrudei Weber, 1911.

PSEUDOMUGIL GERTRUDEI Weber, *Abh. Senckenb. Nat. Ges.,* **34,** 23, pl. 1, fig. 4, text figs. 2, 3, 1911.
Type-locality.—Fresh water at Ngaiguli, Terangan Island, Aru Islands.
Range.—Fresh waters of the Aru Islands.

XIII. TELMATHERINA Boulenger, 1897.

TELMATHERINA Boulenger, *Proc. Zool. Soc. London,* 428, 1897.
Orthotype.—TELMATHERINA CELEBENSIS Boulenger.
Range.—Fresh waters of Celebes.

The rather deep body, relatively few vertebræ (17 + 16) and the filamentous dorsal spines indicate a relationship of this genus with the MELANOTÆNIINÆ, especially PSEUDOMUGIL.

22. Telmatherina celebensis Boulenger, 1897.

TELMATHERINA CELEBENSIS Boulenger, *Proc. Zool. Soc. London,* 428, pl. 28, fig. 3, 1897; Weber, *Bijd. Dierk. Amsterdam,* 206, fig. 3, 1913.
Type-locality.—Lake Matanna, Celebes.
Range.—Lakes (Matanna, Towuti) of Celebes.

23. Telmatherina abendanoni Weber, 1913.

TELMATHERINA ABENDANONI Weber, *Bijd. Dierk. Amsterdam,* 208, fig. 6, 1913.
Type-locality.—Soroako, on Lake Matanna, Celebes.
Range.—Lake Matanna, Celebes.

Subfamily ATHERININÆ.

ATHERININA Günther, *Catalogue Fishes Brit. Mus.,* **3,** 391, 1861 (in part).
ATHERININÆ Fowler, *Proc. Acad. Nat. Sci. Phila.,* **40,** 727, 1904 (in part).

This group is defined in the key to the genera. It contains all the Old World marine atherines and a few species from tropical America, on the Atlantic side. Most of the species have been placed in a single genus, ATHERINA. From this we separate out a large group, HEPSETIA, with ATHERINA BOYERI as its type, and several smaller groups. Many of the Australian and South Pacific forms are in especial need of critical study, as regards both their generic and specific status.

XIV. ATHERION Jordan and Starks, 1901.

ATHERION Jordan and Starks, *Proc. U. S. Nat. Mus.,* **24,** 203, 1901.
Orthotype.—ATHERION ELYMUS Jordan and Starks.
Range.—Shores of the western Pacific.

This genus comprises two small fishes, very aberrant, but obviously allied to ATHERINA.

24. Atherion elymus Jordan and Starks, 1901.[St.]

(Plate I, Fig. 1.)

ATHERION ELYMUS Jordan and Starks, *Proc. U. S. Nat. Mus.,* **24,** 203, fig. 3, 1901.
Type-locality.—Tide-pools at Misaki, Sagami, Japan.
Range.—Shores of southern Japan.

25. Atherion maccullochi Jordan and Hubbs, 1919.*St.*

ATHERION MACCULLOCHI Jordan and Hubbs, new species.

Type-locality.—Lord Howe Island.

Range.—Lord Howe Island, east of Australia.

Holotype.—A specimen 49 mm. long to caudal base, from Lord Howe Island; received from Mr. Allan R. McCulloch. Two paratypes, 45 mm. long, from the type locality, are also at hand. All are deposited in the collections of Stanford University.

The ATHERION of Lord Howe Island is closely related to A. ELYMUS of Japan. It differs from that species principally in the somewhat smaller size of the scales.

Body slender and compressed; the depth, greatest through the pectoral fins, contained 6.4 times in total length to caudal; least depth of caudal peduncle about three-fourths length of head. Belly rather narrowly flattened transversely. Length of head, 4.4 (about 4.2 in paratypes); head formed as in A. ELYMUS, rounded anteriorly, convex in cross section dorsally; dorsal contour slightly depressed behind end of premaxillary processes; tip of premaxillaries slightly above horizontal passing through middle of eye. Mouth very oblique and small, the upper jaw not extending to below front of eye, its length 3.6; eye, 3; snout, 4. Rami of mandibles elevated within the mouth. Teeth of the jaws small, but less minute than in some species of ATHERINA, arranged in a single series, which is apparently followed near front of jaws by small teeth; fine teeth also evident on the vomer, behind which the roof of the mouth is lined with rows of fine, apparently edentulous, granulations. Gill-rakers slender, serrulate on inner edge, about half as long as eye, 3 + 13 in number. The head is partly covered with finely spinulose ridges, as in A. ELYMUS. The maxillary is covered with these fine spinules, and there are several series on the mandible; a series below eye; others covering the preopercular ridge, the lower surface of the preopercle below the ridge, and the exposed surface of the interopercle; a row of several series on superior orbital rim, and several series on the sides of the snout.

Scale rows, 47-7 (43-7 in A. ELYMUS), 20 to 22 from first dorsal to occiput (16 in A. ELYMUS); a few large scales on opercle, and a row on the suborbital. Scales from the sides of the body about twice as deep as long, with entire edges, and without circuli on the exposed field.

Fin-rays: dorsal, IV, 10 or 11; anal, I, 15 or 16 (I, 14 anal rays counted in the type and two paratypes of A. ELYMUS). Origin of spinous dorsal equidistant from base of caudal and middle of snout; length of first dorsal when depressed about 1.5 times the interspace between the depressed dorsals. Base of second dorsal extending from above the middle.

to a little behind the end, of the anal base, contained 1.6 times in the head; anal base also shorter than head. Insertion of ventrals equidistant from origin of anal and from hind part of eye, as in A. ELYMUS.

Coloration dark, blackish on middle of dorsal scales, on the bases of the vertical fins, on top of head behind middle of eyes, on the snout, on the sides of the lower jaw, and over the surface of the gill chamber. The dark lateral band, as broad as the snout is long, was probably overlaid with silvery in life, as in ATHERINA; it becomes narrow posteriorly, but dilated again at base of caudal. Dorsal and caudal fins dusky, the others clear.

XV. HEPSETIA Bonaparte, 1837.

HEPSETIA Bonaparte, *Fauna Italica,* fasc. 91, no pagination; Jordan, *Copeia,* 47, No. 32, 1916.

Orthotype.—ATHERINA BOYERI Risso.

ATHERINOMORUS Fowler, *Proc. Acad. Nat. Sci. Phila.,* **40,** 730, 1904.

Orthotype.—ATHERINA LATICEPS Poey (= ATHERINA STIPES Müller and Troschel).

Range.—Shores of the tropical Atlantic from Florida southward; Mediterranean Sea; Red Sea; Indian Ocean; East Indies; southern Japan; Hawaiian Islands; Australia, Tasmania, and New Zealand.

This genus, which we separate from ATHERINA as currently recognized, was indicated as an unnamed group by Cuvier and Valenciennes, and named by Bonaparte and later by Fowler. Fowler was the first to note the taxonomic value of the shape of the lower jaw. In HEPSETIA, the rami of the mandibles are more slender in form than in ATHERINA; the upper edge straight, not abruptly elevated behind. In the various regions where they both occur, the two groups are usually distinguishable by means of a combination of other characters, a fact strongly indicating that the distinction of the groups is natural. None of the differential characters when considered alone, however, is very sharply defined. The species of the group we call HEPSETIA usually differ from those of typical ATHERINA in their shorter and blunter premaxillary spine, the shorter and more rounded snout, the larger eye, wider interorbital, longer head, deeper body, and larger scales.

26. Hepsetia boyeri (Risso), 1810.[St.]

ATHERINA HEPSETUS, var. 3 Delaroche, *Ann. Mus. Hist. Nat. Paris,* **13,** 357, 1809.

ATHERINA BOYERI Risso, *Ichth. Nice,* 338, pl. 10, fig. 38, 1810; Günther, *Catalogue Fishes Brit. Mus.,* **3,** 394, 1861 (in part); Borsieri *Ann. Agricolt.,* 31, pl. 8, 1902 (1904).

ATHERINA BOIERI Cuvier and Valenciennes, *Hist. Nat. Poiss.,* **10,** 432, pl. 303, 1835.

Type-locality.—Nice, France.

Range.—Mediterranean Sea.

Günther's description of this species applies much better to ATHERINA HEPSETUS. Some of his specimens apparently should have been referred to ATHERINA PRESBYTER.

In HEPSETIA BOYERI the mandibular rami are slender and not elevated posteriorly, and the premaxillary processes are rather blunt and scarcely more than half as long as the eye. The specimen examined by us, from the United States National Museum, is part of the Bonaparte collection.

27. Hepsetia pinguis (Lacépède), 1803).[St.]

ATHERINA PINGUIS Lacépède, *Hist. Poiss.*, **5**, 372, pl. 11, 1803; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 399, 1861; Day, *Fishes of India*, 334, 1876; Klunzinger, *Verh. Zool.-bot. Ges. Wien*, **20**, 833, 1870; *Fische des Rothen Meeres*, 130, 1884; Sauvage, *Hist. Madag., Poiss.*, 409, 1891; Ogilby, *Mem. Queensl. Mus.*, **1**, 38, pl. 12, fig. 1, 1912.

Type-locality.—Mauritius.

ATHERINA AFFINIS Bennett, *Proc. Zool. Soc. London*, 166, 1831.

Type-locality.—Mauritius.

ATHERINA PUNCTATA Bennett, *Proc. Zool. Soc. London*, 184, 1832.

Type-locality.—Mauritius.

ATHERINA PECTORALIS Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 447, 1835.

Type-locality.—Mauritius (now restricted).

ATHERINICHTHYS CEPHALOTES Castelnau,[12] *Proc. Zool. Soc. Victoria*, **1**, 137, 1872; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 43, 1881 (1882) (after Castelnau).

Type-locality.—Victoria.

? ATHERINICHTHYS PICTA Castelnau, *Proc. Zool. Soc. Victoria*, **1**, 137, 1872; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 42, 1881 (1882) (after Castelnau).

Type-locality.—Capt. Sinnot's Dock, on the lower Yarra, Australia.

? ATHERINICHTHYS MODESTA Castelnau, *Proc. Zool. Soc. Victoria*, **1**, 137, 1872; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 42, 1881 (1882) (after Castelnau).

Type-locality.—Hobson's Bay, Australia (now restricted).

ATHERINA LACUNOSA Günther, *Journ. Mus. Godeffr.*, **13**, 213, pl. 118, fig. E, 1877; Waite, *Rec. Canterb. Mus.*, **1**, 15, 1907 (not of Forster).

ATHERINA FORSKALI Jordan and Starks, *Ann. Carn. Mus.*, **11**, 439, 1917; Jordan and Hubbs, *ibid.*, 462, pl. 46 (not of Rüppell).

Range.—Mauritius (Lacépède) and the eastern coast of Africa (Günther), north to the Gulf of Suez (Cuvier and Valenciennes) and the eastern Mediterranean, apparently having passed through the Suez Canal (Jordan and Hubbs); eastward to India (Day), East Indies (Bleeker), and New Guinea (Alleyne and Macleay); Australia (Ogilby) to New Caledonia, New Hebrides, and Fiji Islands (Günther); ?New Zealand (Hutton).

As Mr. Ogilby has suggested, it is probable that a detailed study of this form throughout the wide range which has been ascribed to it, would indicate that it is really divisible into several local species.

The discovery by us of this species in the Mediterranean is the first

[12] Mr. Allan R. McCulloch mentions in correspondence, that, judging from a photograph of the type in the Paris Museum, ATHERINICHTHYS CEPHALOTES is merely A. PINGUIS Lacépède. Castelnau's PICTA and MODESTA may also belong here, but the brevity and inaccuracy of the descriptions make the reference doubtful.

indication with which we are acquainted, that the Suez Canal has served as a channel through which fishes have extended their ranges.

In H. PINGUIS the premaxillary processes are about half as long as the eye, and the mandibular rami are not elevated posteriorly.

28. Hepsetia edelensis (Castelnau), 1872.

ATHERINICHTHYS EDELENSIS Castelnau, *Proc. Zool. Soc. Victoria,* **2,** 134, 1873; Macleay, *Proc. Linn. Soc. N. S. Wales,* **6,** 42, 1881 (1882) (after Castelnau).
Type-locality.—Freemantle, western Australia.
Range.—Shores of western Australia.

The inadequate description of this species renders its generic disposition doubtful.

29. Hepsetia lacunosa (Forster), 1801.

ATHERINA LACUNOSA Forster, in Bloch and Schneider, *Syst. Ichth.,* 112, 1801; *idem., Desc. Anim.,* Lichtenstein ed., 298, 1844; Ogilby, *Mem. Queensl. Mus.,* **1,** 40, pl. 12, fig. 2, 1912.
Type-locality.—New Caledonia.
Range.—New Caledonia and eastern Australia.

We follow Mr. Ogilby in accepting this species. It is possible that it should be retained in ATHERINA.

30. Hepsetia morrisi (Jordan and Starks), 1906.[St.]

(Plate I, Fig. 2)

ATHERINA MORRISI Jordan and Starks, *Proc. U. S. Nat. Mus.,* **30,** 697, fig. 3, 1906.
Type-locality.—Miyanoura, Yaku Island, southeast of Kiusiu, Japan.
Range.—Shores of islands of southern Japan.

HEPSETIA MORRISI is closely related to H. PINGUIS. It agrees with that species in the characters of the mandibular rami and premaxillary processes.

31. Hepsetia insularum (Jordan and Evermann), 1903.[St.]

(Plate I, Fig. 3)

ATHERINA INSULARUM Jordan and Evermann, *Bull. U. S. Fish. Comm.,* **22,** 170, 1902 (1903); **23,** 138, fig. 47, 1903 (1905).
Type-locality.—Honolulu, Hawaii.
Range.—Hawaiian Islands.

Gill-rakers, $7 + 23$; vomerine teeth moderate; mandibular rami not elevated within the mouth.

32. Hepsetia valenciennesii (Bleeker), 1853.

ATHERINA VALENCIENNESII Bleeker, *Nat. Tijdschr. Neder.-Indië,* **5,** 507, 1853; *Günther, Catalogue Fishes Brit. Mus.,* **3,** 398, 1861 (after Bleeker).
Type-locality.—Padang.
Range.—Shores of the East Indies (Padang, Batavia, and Singapore).

This species may belong in ATHERINA.

33. Hepsetia afra (Peters), 1855.

ATHERINA AFRA Peters, *Archiv. Naturg.*, **1**, 244, 1855; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 398, 1861 (after Peters).
Type-locality.—Coast of Mozambique.
Range.—Shores of eastern Africa.

34. Hepsetia regina (Seale), 1909.

ATHERINA REGINA Seale, *Phila. Journ. Sci.* (A), **4**, 496, pl. 3, fig. 1, 1909.
Type-locality.—Culion Island, Philippine Islands.
Range.—Philippine Islands (recorded from Culion and Busuanga).

35. Hepsetia balabacensis (Seale), 1909.[St.]

ATHERINA FORSKALII Evermann and Seale, *Bull. U. S. Bur. Fish.*, **26**, 59, 1906 (1909) (not of Rüppell).
ATHERINA (?) LACUNOSA Jordan and Richardson, *Bull. U. S. Bur. Fish.*, **27**, 243, 1907 (not of Forster).
ATHERINA BALABACENSIS Seale, *Phila. Journ. Sci.* (A) **4**, 498, pl. 3, fig. 2, 1909.
Type-locality.—Near mouth of small stream, Balabac Island, Philippine Islands.
Range.—Philippine Islands.

We have re-examined the material recorded as A. FORSKALII by Evermann and Seale and that doubtfully named A. LACUNOSA by Jordan and Richardson, and find both lots referable to H. BALABACENSIS. This species is perhaps indistinguishable from the next.

36. Hepsetia lineata (Günther), 1872.

ATHERINA LINEATA Günther, *Ann. Mag. Nat. Hist.*, **10**, 398, 1872.
Type-locality.—Cebu.
Range.—East Indies.

37. Hepsetia duodecimalis (Cuvier and Valenciennes), 1835.

ATHERINA DUODECIMALIS Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 458, 1835; Bleeker, *Nat. Tijdschr. Neder.-Indië*, **2**, 485, 1851; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 400, 1861 (after Bleeker).
Type-locality.—Ceylon.
Range.—Ceylon; East Indies.

38. Hepsetia brachyptera (Bleeker), 1851.

ATHERINA BRACHYPTERA Bleeker, *Nat. Tijdschr. Neder.-Indië*, **2**, 243, 1851; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 401, 1861 (after Bleeker).
Type-locality.—Coast of Banda Nera.
Range.—East Indies.

This species perhaps belongs in ATHERINA.

39. Hepsetia stipes (Müller and Troschel), 1848.[St.]

(Plate I, Fig. 4)

?ATHERINA TÆNIATA Spix, in Agassiz, *Pisc. Brazil.*, 135, pl. 30, fig. 2, 1829.
CHIROSTOMA (?)TÆNIATUM Ribeiro, *Arch. Mus. Nac. Rio de Janeiro*, **17**, "Trematolepides," 10, 1915.
Type-locality.—"Atlantic Ocean" (off Brazil).

ATHERINA STIPES Müller and Troschel, in Schomburgk, *Hist. Barbadoes*, 671, 1848; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 400, 1861; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 790, 1896; pt. 4, pl. 122, fig. 332, 1900.

Type-locality.—Barbadoes.

ATHERINA LATICEPS Poey, *Mem. Hist. Nat. Cuba*, **2**, 790, 1861; Jordan and Everman, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 790, 1896.

Type-locality.—Havana, Cuba.

ATHERINA VELIANA Goode and Bean, *Proc. U. S. Nat. Mus.*, **1**, 342, 1879.

Type-locality.—Clear Water Harbor, Florida.

Range.—Shores of the western Atlantic from Florida to Panama; West Indies.

We have examined large series of HEPSETIA from the shores of the western Atlantic, but fail to distinguish more than one species. The name TÆNIATA may be applicable to this species, but the original description and figure of TÆNIATA indicate a fish with smaller head and more anal rays. Our material comes from Florida (Key West; Barnes Sound; Dry Tortugas); Cuba, Porto Rico; Bahamas; Jamaica; British Honduras, and Panama.

HEPSETIA STIPES corresponds in all respects to our diagnosis of the genus.

40. Hepsetia evermanni (Eigenmann), 1903.[St.]

(Plate II, Fig. 5)

ATHERINA EVERMANNI Eigenmann, *Bull. U. S. Fish Comm.*, 228, fig. 9, 1902 (1903).

Type-locality.—San Cristobal, Cuba.

Range.—Fresh waters of Cuba.

This species has larger scales than any other form of the genus, and the anal fin is unusually large, as also in H. INSULARUM.

XVI. ATHERINA Linnæus, 1758.

ATHERINA (Artedi) Linnæus, *Syst. Nat.*, ed. 10, 315, 1758; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 392, 1861 (in part); Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 404, 1883 (in part); Jordan and Evermann, *ibid.*, **47**, pt. 1, 789, 1896 (in part); Borsieri, *Ann. Agricolt.*, 16, 1902 (1904) (in part); Fowler, *Proc. Acad. Nat. Sci. Phila.*, **40**, 727, 1904 (in part).

Haplotype.—ATHERINA HEPSETUS Linnæus.

TÆNIOMEMBRAS Ogilby, *Proc. Linn. Soc. N. S. Wales*, **23**, 41, 1898; McCulloch, *Zool. Res. Fish. Exp. Endeavour*, pt. 1, 32, 1911.

Orthotype.—ATHERINA MICROSTOMA Günther.

Range.—In the Atlantic Ocean from the Bermudas and Florida to Panama, and from the Scandinavian Peninsula and England to the Madeira and Canary Islands; Mediterranean, Black, and Caspian Seas; South Africa; Madagascar; Indian Ocean; East Indies, and north to central Japan, east through the Pacific Islands, and southeast to eastern Australia and Tasmania.

Even in the restricted sense in which we adopt it, the genus ATHERINA comprises a large number of species which differ considerably from one another. The variations of chief significance involve the position of the first dorsal, the position of the anus in reference to anal and ventral fins, the size of the scales, the size of the mouth, the length

of the premaxillary processes, etc. Several of the species have been described as lacking vomerine teeth, a character in need of confirmation.

41. Atherina hepsetus Linnæus, 1758.[St.]

ATHERINA HEPSETUS Linnæus, *Syst. Nat.*, ed. 10, 315, 1758; Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10,** 423, pl. 302, 1835; Günther, *Catalogue Fishes Brit. Mus.*, **3,** 393, 1861; Borsieri, *Ann. Agricolt.*, 24, pl. 7, 1902 (1904).

Type-locality.—Mediterranean Sea.

? ATHERINA PRESBYTER Guichenot, *Exp. Sci. Algérie*, **3,** 66, 1850 (? not of Cuvier).

? ATHERINA LACUSTRIS Martens, *Arch. Naturg.*, **23,** 167, pl. 9, figs. 1, 2, 1857 (? in part); Günther, *Catalogue Fishes Brit. Mus.*, **3,** 394, 1861.

? ATHERINA BOYERI Günther, *Catalogue Fishes Brit. Mus.*, **3,** 394, 1861 (in part).

ATHERINA BOYERI Jordan and Gunn, *Proc. Acad. Nat. Sci. Phila.*, 340, 1898 (not of Risso).

Range.—Mediterranean Sea; ? lakes of Italy; Black Sea; Canary Islands.

The specimens of ATHERINA from the Canaries, recorded by Jordan and Gunn as A. BOYERI, are apparently referable to A. HEPSETUS, as they have 13 soft anal rays and almost 55 rows of scales. The island form, however, requires further study, for it may prove to be a distinct species. Lowe's record of A. PRESBYTER from Madeira may be based on the same island species.

42. Atherina presbyter Cuvier, 1829.

ATHERINA PRESBYTER Cuvier, *Règne Anim.*, **2,** 235, ed. 2, 1829; *Règne Anim., Ill. Poiss.*, pl. 76, fig. 3; Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10,** 439, pl. 305, 1835; Günther, *Catalogue Fishes Brit. Mus.*, **3,** 392, 1861; Borsieri, *Ann. Agricolt.*, 18, pl. 6, 1902 (1904).

Type-locality.—Ocean shore of Europe.

Range.—Atlantic coast of Europe, north to England and the Scandinavian Peninsula.

43. Atherina caspia Eichwald, 1831.[St.]

ATHERINA HEPSETUS, var. 2 Delaroche, *Ann. Mus. Hist. Nat. Paris*, **13,** 358, 1809.

ATHERINA PRESBYTER, var. CASPIA Eichwald, *Zoologia Specialis*, 72, 1831.

ATHERINA CASPIA Eichwald, *Bull. Soc. Imp. Nat. Moscou*, **3,** 136, 1838; *Nouv. Mém. Soc. Imp. Nat. Moscou*, **7,** 205, pl. 33, figs. 1, 2, 1841.

Type-locality.—Caspian Sea. ("e sinu balchanensis").

ATHERINA PRESBYTER, var. PONTICA Eichwald, *Zoologia Specialis*, 72, 1831.

ATHERINA PONTICA Eichwald, *Bull. Soc. Imp. Nat. Moscou*, **3,** 137, 1838; *Nouv. Mém. Soc. Imp. Nat. Moscou*, **7,** 206, pl. 33, figs. 3, 4, 1841; Günther, *Catalogue Fishes Brit. Mus.*, **3,** 393, 1861.

Type-locality.—Near Odessa, on the Black Sea.

ATHERINA MOCHON Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10,** 434, pl. 304, 1835; Steindachner, *Sitzb. Akad. Wiss. Wien*, **57,** 678, 1868; Lönnberg, *Bih. Svenska Vet.-Akad., Handl.*, **26,** pt. 4, No. 8, p. 8, 1900; Boulenger, *Zool. Egypt*, 3 (Fishes Nile), 423, 1907; *Catalogue Fresh-water Fishes Africa*, **4,** 74, 1916.

ATHERINA MOCHO Günther, *Catalogue Fishes Brit. Mus.*, **3,** 399, 1861 (altered spelling).

Type-locality.—Iviza, Mediterranean Sea.

ATHERINA RISSO Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10,** 435, 1835, Moreau, *Hist. Nat. Poiss. France,* **3,** 210, 1881.

ATHERINA RISSOI Borsieri, *Ann. Agricolt.,* 47, pl. 10, 1902 (1904).

Type-locality.—Nice, France.

ATHERINA SARDA Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10,** 435, 1835; Carus, *Prodr. Fauna Med., Pisces,* 704, 1893.

Type-locality.—Sardinia.

ATHERINA LACUSTRIS Bonaparte, *Fauna Italica, Pesci,* **3,** no pagination, pl. 91, fig. 3, 1836; Martens, *Arch. Naturg.,* **23,** 167, pl. 9, figs. 1, 2, 1857 (? in part only); Fowler, *Proc. Acad. Nat. Sci. Phila.,* **40,** 727, 1904.

? ATHERINA LACUSTRIS Günther, *Cat. Fishes Brit. Mus.,* **3,** 394, 1861 (? in part).

Type-locality.—Lake Albano, Italy (now restricted).

ATHERINA BOIERI Depéret, *Bull. Soc. Hist. Nat. Toulouse,* **17,** 82, 1883 (not of Risso).

ATHERINA HYALOSOMA Facciola, in Cocco, *Nat. Sicil.,* **4,** 239, 1885; Carus, *Prodr. Fauna Med., Pisces,* 704, 1893.

Type-locality.—Italy.

ATHERINA RIQUETI Roule, *Zool. Anz.,* **25,** 262, 4 figs., 1902; *Feuille Jeunes Natural., Paris* (4), **32,** 172, figs., 1902; *Nature, Paris,* **30,** pt. 2, 56, 3 figs., 1902; *C. R. Acad. Sci. Paris,* **136,** 824, 1903; **137,** 1276, 1903.

ATHERINA MOCHON, var. RIQUETI Boulenger, *Zool. Egypt,* **3** (Fishes Nile), 424, 1907.

Type-locality.—Canal du Midi, France.

ATHERINA SARDINELLA Fowler, *Proc. Acad. Nat. Sci. Phila.,* **40,** 729, pl. 41, upper figure, 1904.

Type-locality.—Italy.

ATHERINA MOCHON, var. ÆGYPTIACA Boulenger, *Zool. Egypt,* **3** (Fishes Nile), 424, fig., 1907; *Catalogue Fresh-water Fishes Africa,* **4,** 75, fig., 1916.

Type-locality.—Lakes of Egypt.

Range.—Mainland and island shores of the Mediterranean Sea, and the adjacent lakes.

This form enters fresh water, like other fishes of similar habit forming there numerous local races. Whether some of these races are sufficiently distinct to warrant their recognition in nomenclature, either as subspecies or species, must be determined by those having extensive series. Having but few specimens, we provisionally follow Boulenger in uniting all under a common name. We note, however, that the name CASPIA has clear priority, a fact which seems wholly to have escaped the attention of European ichthyologists. If for some reason the name CASPIA should prove unavailable, then PONTICA should be used. These two names were first proposed by Eichwald in 1831, four year before Cuvier and Valenciennes fixed the name MOCHON upon Delaroche's ATHERINA HEPSETUS, var. 2 (see synonomy). It is true that Delaroche applied the names "MOCHO ou MOCHON" to this form in 1809, but in the vernacular sense; similarly he applied the names "CHUCLET ou PESCIO REY" to his var. 1, which is currently identified with typical A. HEPSETUS. In 1810 five other species[13] of ATHERINA were described, all from Italy,

[13] ATHERINA MARMORATA Risso, *Ichth. Nice,* 339, 1810 (young); ATHERINA MINUTA Risso, *ibid.,* 340 (young) ATHERINA CORONEDA, A LATTARINA, and A. NUNNATA, Rafinesque, *Caratteri,* 57, 1810.

but the descriptions contain little that is tangible. Some of these, of course, may have been based upon the species under discussion.

The preliminary diagnosis of CASPIA and PONTICA, apparently not being readily accessible, we reprint below.

"1. A. PRESBYTER Cuv., A. HEPSETUS L., rostro breviore pinna dorsi priore 8, secunda 12, anali 15-16 radiis. Hab. in oceano, caspio mari et nigro;

var. CASPIA, e sinu balchanensi, 4 poll. 8 lin. longa, dorso crassissimo, plano, fronte recta, ore supero, ita ut suprema pars extrema maxillæ utriusque cum supremo margine maximi oculi tumidi in una linea sita sit; fascia argentea omnino recta;

var. PONTICA prope Odessam parum minor, dorso abdominesque minus crassis, acutioribus, fronte valde declivi, ita ut oris extrema pars acuminata cum inferiore margine pupillæ in eadem linea adpareat; pinna dorsi prior plurimum 8, secunda 12-13, at analis 14-15 radiis instructa; apud ill. PALLASIUM (zoogr. ross. p. 225), numerantur, nescioquo jure, in utraque pinna dorsi 9 radii, et 12 in anali."

44. Atherina bonapartii Boulenger, 1907.[St.]

ATHERINA MOCHON Borsieri, *Ann. Agricolt.*, 39, pl. 9, 1902 (1904) (and of Italian authors in general, but not of Delaroche and Cuvier and Valenciennes, *fide*, Boulenger).

ATHERINA BONAPARTII Boulenger, *Zool. Egypt*, **3** *(Fishes Nile)*, 426, 1907.

Type-locality.—Shores of Italy (by inference).

Range.—Shores of Italy.

45. Atherina carolina Cuvier and Valenciennes, 1835.

ATHERINA CAROLINA Cuvier and Valenciennes, *Hist. Nat. Poss.*, **10**, 445, 1835; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 791, 1896.

Type-locality.—Carolina (probably an error).

Range.—Unknown.

46. Atherina harringtonensis Goode, 1877.[St.]

There are two American forms of true ATHERINA. As they differ only in average characters, we regard them as subspecies. Both have the mandibular rami elevated posteriorly; the premaxillary spines slender and a little more than half as long as the eye; the snout not very short and blunt; the interorbital not very broad; the eye not very large; the head not very large; the body rather slender and not strongly compressed. The anus is about twice as distant from the anal fin as from the insertion of the short ventrals; these fins extending little beyond the anus.

46a. Atherina harringtonensis harringtonensis Goode, 1877.[St.]

ATHERINA HARRINGTONENSIS Goode, *Amer. Journ. Sci. Arts* (3), **14**, 297, 1877; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 791, 1896; Bean, *Publ. Field Mus. (Zool.)*, **7**, 40, 1906.

Type-locality.—Harrington Sound; Bermudas.

Range.—"All of the lagoons and protected bays of the Bermudas" (Goode).

This island variety differs from the form of the mainland and the West Indies only in average characters: the scales are usually more

numerous, the fin rays more numerous, and the head shorter. The variations of these characters are indicated in the following tables:

TABLE OF COUNTS AND MEASUREMENTS.

Locality	Bermudas							
	Castle Harbor	Shelly Bay	Nonesuch Bay		Packward's Bay	Long Bird Is.	Soldier Bay	
Fin rays: first dorsal	VI	V	VI	VII	V	VI	VI	VI
" " second dorsal	I, 11	I, 11	I, 11	I, 11	I, 11	I, 10	I, 10	I,10
" " anal	I, 12	I, 13	I, 12	I, 12	I, 12	I, 12	I, 12	I, 12
Scales: transverse rows	47	46	47	46	50	47	44	46
" longitudinal rows	7	7	7	6	8	7	7	7
Depth of body	6.6	6.0	6.0	6.0	5.6	6.7	6.6	6.2
Depth of caudal peduncle	3.4	3.4	3.7	3.5	3.5	4.0	3.4	3.5
Length of head	4.5	4.6	4.3	4.4	4.3	4.3	4.2	4.0
Diameter of eye	2.7	2.65	2.8	2.7	2.8	3.0	2.6	2.6
Width of interorbital	2.9	3.1	3.3	3.0	3.2	3.0	2.7	2.8
Length of snout	4.0	3.7	3.7	3.6	3.7	3.8	4.0	4.0
Length to caudal, mm	60	52	56	55	55	66	46	43

46b. *Atherina harringtonensis araea* (Jordan and Gilbert), 1884.[St.]

(Plate III, Fig. 9)

ATHERINA ARÆA Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **7**, 27, 1884; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 790, 186; **4**, pl. 123, fig. 333, 1900; Evermann and Marsh, *Bull. U. S. Fish. Comm.*, 111, fig. 23, 1900; Cockerell, *Proc. Biol. Soc. Wash.*, **28**, 151, 157, 1915.

Type-locality.—Key West, Florida.

Range.—From the Florida Keys to the Atlantic coast of Panama; Porto Rico.

TABLE OF COUNTS AND MEASUREMENTS

Locality	Key West		Culebra, Porto Rico		Isthmus of Panama				Locality doubtful[14]	
Fin rays: first dorsal	VI	—	VI	V	V	V	VI	V	—	—
" second dorsal	—	—	I, 10	I, 10	I, 9	I, 10	I, 10	I, 10	—	—
" anal	—	—	I, 11	I, 12	I, 11	I, 11	I, 12	I, 11	—	—
Scales: transverse rows	44	43	43	43	43	43	44	42	44	43
" longitudinal rows	7	7	7	7	7	7	6	6	—	—
Depth of body	—	—	6.4	6.2	5.65	5.6	5.6	5.7	—	—
Depth of caudal peduncle	—	—	3.8	4.0	3.5	3.7	3.5	3.6	—	—
Length of head	4.2	—	3.9	3.7	3.9	3.8	3.9	4.3	3.7	3.65
Diameter of eye	2.6	—	2.7	2.65	2.7	2.6	2.8	2.65	2.6	2.6
Width of interorbital	3.2	2.8	3.3	3.0	3.1	3.0	3.0	3.2	3.3	3.4
Length of snout	3.7	—	3.7	4.0	4.0	4.0	3.8	4.0	3.8	3.9
Length to caudal, mm	38	36	50	46	52	52	45	46	45	41

[14] Probably Key West or Porto Rico.

47. Atherina breviceps Cuvier and Valenciennes, 1835.

ATHERINA BREVICEPS Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 445, 1835; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 395, 1861.

Type-locality.—Cape of Good Hope.

Range.—Shores of Southern Africa.

48. Atherina parvipinnis Cuvier and Valenciennes, 1835.

ATHERINA PARVIPINNIS Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 446, 1835; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 396, 1861; Sauvage, *Hist. Madag., Poiss.*, 408, pl. 43, fig. 3, 1891.

Type-locality.—Cape of Good Hope.

Range.—Shores of southern Africa and Madagascar.

49. Atherina forskalii (Rüppell), 1837.[St.]

? ATHERINA HEPSETUS Forskål, *Descr. Anim.*, 69, 1775 (not of Linnæus).

ATHERINA FORSKALII Rüppell, *Neue Wirbelthiere, Fische*, 132, pl. 33, fig. 1, 1837; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 397, 1861; Day, *Fishes of India*, 345, pl. 71, fig. 4, 1876.

ATHERINA FORSKALII Klunzinger, *Fische des Rothen Meeres*, 130, pl. 11, fig. 3, 1884.

Type-locality.—Djedda, on the Arabian side of the Red Sea.

Range.—Red Sea to the East Indies.

Specimens apparently of the species from Bombay, received under the name of FORSKALII from the British Museum, have the mandibular rami elevated posteriorly. This fact indicates that the species should be retained in ATHERINA, although it bears considerable resemblance to such species of HEPSETIA as H. PINGUIS.

A. FORSKALII seems to have been unknown to American writers. The specimens recorded by them under that name prove upon re-examination to be referable to HEPSETIA PINGUIS, and H. BALABACENSIS.

50. Atherina bleekeri Günther, 1861.[St.]

ATHERINA JAPONICA Bleeker, *Verh. Bat. Gen.*, **25**, 40, fig. 2, 1853 (not ATHERINA JAPONICA Houttuyn, a clupeid fish).

Type-locality.—Nagasaki, Japan.

ATHERINA BLEEKERI Günther, *Catalogue Fishes Brit. Mus.*, **3**, 398, 1861; Jordan and Starks, *Proc. U. S. Nat. Mus.*, **24**, 201,1901.

Type-locality.—China.

ATHERINA VALENCIENNESI Nyström, *Svenska Vet. Akad., Handl.*, **13**, pt. 4, No. 4, 38, 1887 (not of Bleeker).

Range.—Shores of China and of Japan, north to Tokyo.

The mandibular rami of this species and the next are moderately elevated posteriorly. The anus in each is extremely advanced in position, being about opposite the middle of the ventrals.

51. Atherina woodwardi Jordan and Starks, 1901.St.

(Plate II, Fig. 6)

ATHERINA (?) PINGUIS Ishikawa and Matsuura, *Prel. Cat. Fishes, Tokyo,* 33, 1897 (not ATHERINA PINGUIS Lacépède).

ATHERINA WOODWARDI Jordan and Starks, *Proc. U. S. Nat. Mus.,* **24,** 200, fig. 1, 1901.

Type-locality.—Okinawa, one of the islands of the Riukiu groups.

Range.—Shores of the Riukiu Archipelago.

52. Atherina endrachtensis (Quoy and Gaimard), 1824.

ATHERINA ENDRACHTENSIS Quoy and Gaimard, *Voy. Uranie, Zool.,* 334, 1824; Cuvier and Valenciennes, *Hist. Nat. Poiss.,* **10,** 456, 1835; Günther, *Catalogue Fishes Brit. Mus.,* **3,** 401, 1861 (after Cuvier and Valenciennes); Kendall and Goldsborough *Mem. Mus. Comp. Zool.,* **26,** 254, 1911.

Type-locality.—Endracht.

Range.—Coasts of Australia, New Guinea, and the islands of the South Pacific.

We are uncertain as to the genus in which this species should be placed.

53. Atherina vaigiensis Quoy and Gaimard, 1824.

ATHERINA VAIGIENSIS Quoy and Gaimard, *Voy. Uranie, Zool.,* 335, 1824; Kendall and Goldsborough, *Mem. Mus. Comp. Zool.,* **26,** 255, 1911.

Type-locality.—Waigiu, near New Guinea.

? ATHERINA CYLINDRICA Cuvier and Valenciennes, *Hist. Nat. Poiss.,* **10,** 453, 1835.

Type-locality.—Waigiu (now restricted).

Range.—East Indies and probably the South Sea Islands.

This species, with the three which follow, may belong to HEPSETIA. We have seen none of them.

54. Atherina temminckii Bleeker, 1853.

ATHERINA TEMMINCKII Bleeker, *Nat. Tijdschr. Neder.-Indië,* **5,** 506, 1853; Evermann and Seale, *Bull. U. S. Bur. Fish.,* **26,** 59, 1907.

Type-locality.—Batavia.

Range.—East Indies and Philippine Islands.

55. Atherina bimanensis Bleeker, 1848.

ATHERINA BIMANENSIS Bleeker, *Journ. Ind. Archip.,* **2,** 637, 1848.

Type-locality.—Sumbawa.

Range.—East Indies.

56. Atherina argyrotænia Bleeker, 1849.

ATHERINA ARGYROTÆNIA Bleeker, *Journ. Ind. Archip.,* **3,** 72, 1849.

Type-locality.—Celebes.

Range.—East Indies.

This species is usually known as ATHERINA ARGYROTÆNIATA, *an* unnecessary alteration of spelling adopted by Bleeker in 1858.

57. Atherina tsurugæ Jordan and Starks, 1902.St.

(Plate II, Fig. 7)

ATHERINA TSURUGÆ Jordan and Starks, *Proc. U. S. Nat. Mus.,* **24,** 202, fig. 2, 1902.

Type-locality.—Nagasaki, Hizen, Japan.

Range.—Shores of eastern Japan from Nagasaki northward to Misaki and Tsuruga.

This species is a true ATHERINA, having the mandibular rami elevated posteriorly, the premaxillary processes more than half as long as the eyes, the head rather pointed, and the body slender.

58. Atherina uisïla Jordan and Seale, 1906.[St.]

ATHERINA UISILA Jordan and Seale, *Bull. U. S. Bur. Fish.*, **25**, 216, fig. 23, 1906; Kendall and Goldsborough, *Mem. Mus. Comp. Zool.*, **26**, 255, 1911.

ATHERINA INSILA Seale, *Phila. Journ. Sci.* (A), **4**, 498, 1909 (misspelled).

Type-locality.—Apia, Samoa.

Range.—Samoan and Marshall Islands, South Pacific.

The mandibular rami are elevated posteriorly in this species, and the premaxillary processes are considerably more than half as long as the eye.

ATHERINA UISILA is related most closely to the Japanese A. TSURUGÆ and the Philippinne A. PANATELA.

59. Atherina panatela Jordan and Richardson, 1908.[St.]

(Plate II, Fig. 8.)

ATHERINA PANATELA Jordan and Richardson, *Bull. U. S. Bur. Fish.*, **27**, 243, fig. 6, 1908.

Type-locality.—Calayan Island, Philippine Islands.

Range.—Philippine Islands.

In this species the premaxillary processes are as long as the eye, and the mandibular rami are elevated posteriorly.

60. Atherina elongata Klunzinger, 1879.

ATHERINA ELONGATA Klunzinger, *Sitzb. Akad. Wiss. Wien*, **80**, 394, pl. 3, fig. 4, 1880.

Type-locality.—King George's Sound.

Range.—Shores about King George's Sound, Australia.

ATHERINA ELONGATA, judging from the original description closely resembles A. MICROSTOMA, and may prove to be identical with it.

61. Atherina microstoma Günther, 1861.[St.]

ATHERINA MICROSTOMA Günther, *Catalogue Fishes Brit. Mus.*, **3**, 401, 1861; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 39, 1881 (1882); Johnston, *Pap. Proc. Roy. Soc. Tasmania*, 122, 1882 (1883); 34, 1890 (1891).

TÆNIOMEMBRAS MICROSTOMUS Ogilby, *Proc. Linn. Soc. N. S. Wales*, **23**, 41, 1898; McCulloch, *Zool. Res. Fish. Exp. Endeavour*, **1**, 32, pl. 10, fig. 2, 1911.

Type-locality.—Tasmania.

Range.—Shores of Tasmania and Victoria.

Mr. McCulloch has sent us specimens of this species from Queenscliff, Victoria. These specimens, like those of the next species examined, have the mandibular rami elevated postriorly, and the premaxillary processes more than half as long as the eye. The gill-rakers in these species are no fewer than in some specimens of A. CASPIA, and the mouth is scarcely smaller than in several other species of the genus. Considering these facts, we do not feel justified in accepting as valid the nominal genus TÆNIOMEMBRAS.

62. Atherina tamarensis Johnston, 1883.St.

ATHERINA TAMARENSIS Johnston, *Pap. Proc. Roy. Soc. Tasmania,* 122, 1882 (1883).
TÆNIOMEMBRAS TAMARENSIS McCulloch and Waite, *Rec. S. Austral. Mus.,* **1,** 41, 1918.
Type-locality.—Launceston Bar, River Tamar, Tasmania.
ATHERINA TASMANIENSIS Macleay, *Proc. Linn. Soc. N. S. Wales,* **9,** 443, 1884 (misprint for TAMARENSIS).
ATHERINICHTHYS CEPHALOTES Zietz, *Trans. Roy. Soc. S. Austral.,* **33,** 264, 1909 (not ATHERINICHTHYS CEPHALOTES Castelnau).
Range.—Shores and streams of Tasmania and South Australia.

63. Atherina presbyteroides Richardson, 1843.

ATHERINA PRESBYTEROIDES Richardson, *Ann. Mag. Nat. Hist.* (1), **11,** 179, 1843; Günther, *Catalogue Fishes Brit. Mus.,* **3,** 397, 1861 (after Richardson); Macleay, *Proc. Linn. Soc. N. S. Wales,* **6,** 37, 1881 (1882) (after Richardson).
Type-locality.—Port Arthur, Tasmania.
Range.—Shores of Tasmania.

The advanced position of the spinous dorsal in this species indicates relationship with A. MICROSTOMA. Possibly the two are identical.

64. Atherina hepsetoides Richardson, 1843.

ATHERINA HEPSETOIDES Richardson, *Ann. Mag. Nat. Hist.* (1), **11,** 178, 1843; Günther, *Catalogue Fishes Brit. Mus.,* **3,** 397, 1861 (after Richardson); Macleay, *Proc. Linn. Soc. N. S. Wales,* **6,** 37, 1881 (1882) (after Richardson).
Type-locality.—Port Arthur, Tasmania.
Range.—Shores of Tasmania.

This species may prove identical with the next.

65. Atherina dannevigi McCulloch, 1911.

ATHERINA HEPSETUS Günther, *Ann. Mag. Nat. Hist.* (4), **17,** 396, 1876 (not of Linnæus).
ATHERINA DANNEVIGI McCulloch, *Zool. Res. Fish. Exp. Endeavour,* **1,** 31, pl. 16, fig. 2, 1911.
Type-locality.—Oyster Bay, Tasmania.
Range.—Shores of Tasmania and southern Australia.

This species has the mandibular rami elevated posteriorly, a character determined for us by Mr. McCulloch. This and other characters seem to place it in the genus ATHERINA. The scales, however, are smaller than in any other species, there being about 75 transverse series. The first dorsal is advanced in position, as in several other Australian species of the genus.

In addition to the type locality, this species was obtained by the *Endeavour* in Spencer Gulf, South Australia, at a recorded depth of 20 fathoms. It is possible, however, that the specimens entered the dredge near the surface.

66. **Atherina gobio** Klunzinger, 1884.

ATHERINA CYLINDRICA Klunzinger, *Verh. zool.-bot. Ges. Wien,* **20,** 834, 1870 (not of Cuvier and Valenciennes).
Type-locality.—Red Sea.

ATHERINA GOBIO Klunzinger, *Fische Rothen Meeres,* 130, pl. 11, fig. 4, 1884 (name a substitute for ATHERINA CYLINDRICA Klunzinger, preoccupied).
Range.—Red Sea.

This species has the appearance of a true ATHERINA, but Klunzinger describes the palate as toothless. This character requires confirmation.

67. **Atherina melanostigma** Day, 1876.

ATHERINA MELANOSTIGMA Day, *Fishes India,* 345, 1876.
Type-locality.—Madras.
Range.—Shores of India.

This species is unknown to us, and may belong in HEPSETIA. According to Dr. Day, it lacks vomerine teeth.

68. **Atherina mugiloides** McCulloch, 1913.

ATHERINICHTHYS PUNCTATUS De Vis, *Proc. Linn. Soc. N. S. Wales,* **9,** 869, 1884 (1885) (not of Bennett).
Type-locality.—Cape York, Australia.

ATHERINA MUGILOIDES McCulloch, *Proc. Roy. Soc. Queensl.,* **24,** 47, fig. 1, 1912 (based on types of ATHERINICHTHYS PUNCTATUS De Vis).
Range.—Northeastern Australia.

Mr. McCulloch informs us that the mandibular rami are elevated posteriorly in this species. In this and other respects it resembles the species of both ATHERINA and CRATEROCEPHALUS. It may be retained in ATHERINA, as the gill-rakers are normal and the mouth fairly large. It resembles the species of CRATEROCEPHALUS and differs from those of ATHERINA, however, in the very large size of the scales and in the lack of vomerine teeth. Several other species of ATHERINA are also described as lacking vomerine teeth; having none of these at hand, we retain them all in ATHERINA.

XVII-XVIII. CRATEROCEPHALUS McCulloch, 1912.

CRATEROCEPHALUS McCulloch, *Proc. Roy. Soc. Queensl.,* **24,** 48, 1912.
Orthotype.—CRATEROCEPHALUS FLUVIATILIS McCulloch.
Range.—Fresh waters of Australia.

This genus is composed of several fresh water ATHERINIDÆ of Australia, allied closely to ATHERINA, but distinguished by the few, almost rudimentary gill-rakers, the lack of vomerine teeth, the small mouth, the pointed snout, and the large scales.

69. Craterocephalus fluviatilis McCulloch, 1912.[St.]

CRATEROCEPHALUS FLUVIATILIS McCulloch, *Proc. Roy. Soc. Queensl.*, **24,** 49, pl. 1, fig. 1, 1912.

Type-locality.—North Yanko Creek, Narrandera, N. S. Wales.

Range.—Murray River drainage, Australia.

70. Craterocephalus stercus-muscarum (Günther), 1867.[St.]

ATHERINA STERCUS-MUSCARUM Günther, *Ann. Mag. Nat. Hist.* (3), **20,** 64, 1867; Macleay, *Proc. Linn. Soc. N. S. Wales,* **6,** 40, 1881 (1882) (after Günther).

Type-locality.—Cape York, Australia.

ATHERINICHTHYS MACULATUS Macleay, *Proc. Linn. Soc. N. S. Wales,* **8,** 207, 1883; **9,** 40, 1884.

CRATEROCEPHALUS MACULATUS McCulloch, *Proc. Roy. Soc. Queensl.,* **24,** 52, pl. 1, fig. 2, 1912.

Type-locality.—Lillesmere Lagoon on the lower Burdekin River, Queensland.

Range.—Coastwise streams of Queensland, north to Cape York, Australia.

Mr. McCulloch has sent us specimens of this species from Eidsvold, Burnett River, Queensland. As in C. FLUVIATILIS, the rami of the mandibles are elevated posteriorly.

71. Craterocephalus eyresii (Steindachner), 1883.

ATHERINICHTHYS EYRESII Steindachner, *Anz. Akad. Wiss. Wien,* 194, 1883; *Sitzb. Akad. Wiss. Wien,* **88,** 1075, 1884 (*Ichth. Beit.,* **13,** 11, 1883).

CRATEROCEPHALUS EYRESII McCulloch and Waite, *Rec. S. Austral. Mus.,* **1,** 43, fig. 27, 1918.

Type-locality.—Australia, probably in the vicinity of Lake Eyre ("während der Lake Eyre-Expedition gesammelt"). See below.

ATHERINA INTERIORIS Zietz, *Proc. Roy. Soc. S. Austral.,* **33,** 264, 1909 (*nomen nudem*).

Type-locality.—"Overflow of the artesian water of Coward and Strangways Springs, Central Australia."

Range.—Fresh waters of south-central Australia.

We suggest that Strangways Springs, in southern central Australia, be regarded as the definite type locality of this species.

72. Craterocephalus honoriæ (Ogilby), 1912.

ATHERINA HONORIÆ Ogilby, *Mem. Queensl. Mus.,* **1,** 42, pl. 12, fig. 3, 1912.

Type-locality.—Nerang Creek, Queensland.

Range.—Streams of Queensland.

The small mouth, short and few gill-rakers, the large scales, and other characters of HONORIÆ seem to place it in or at least near CRATEROCEPHALUS. The dentition is not described. According to McCulloch, the rami of the mandibles are elevated posteriorly.

73. Craterocephalus obscurus (Castelnau), 1875.

ATHERINICHTHYS OBSCURA Castelnau, *Researches Fishes Australia*, 31, 1875; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 43, 1881 (1882) (after Castelnau).

Type-locality.—Swan River, Western Australia.

Range.—Swan River, Western Australia.

The few distinctive features given in Castelnau's description of this fish point toward relationship with the species of CRATEROCEPHALUS.

74. Craterocephalus pauciradiatus (Günther), 1861.

ATHERINA PAUCIRADIATA Günther, *Catalogue Fishes Brit. Mus.*, **3**, 401, 1861; Macleay, *Proc. Linn. Soc. N. S. Wales*, **6**, 39, 1881 (1882) (after Günther).

Type-locality.—Northwestern Australia.

Range.—Northwestern Australia.

This very distinct species seems to be most similar to those of CRATEROCEPHALUS. The gill-rakers are not described.

One of the fresh-water ATHERINIDÆ of New Guinea, described by Dr. Weber as ATHERINICHTHYS NOUHYSI, belongs in the ATHERININÆ but enters none of the genera of that group as we defined them. Hence we were disposed to make it the type of a new genus. It has the body rather more robust than usual in ATHERINA; the eye is less anterior in position, being located in the middle third of the length of the head; the gape is greatly restricted laterally, being only about half as long as the jaws, which do not quite reach to below the front margin of the eye.

Two Australian species, which are apparently not referable to ATHERINA or HEPSETIA, we provisionally include in this group, as they seem to have some characters, at least, in common with A. NOUHUYSI.

In a letter dated September, 1919, Dr. Lieven F. de Beaufort informs us that both Dr. Max Weber and himself regard A. NOUHUYSI as a species of CRATEROCEPHALUS, a view which we provisionally adopt as this memoir passes through the press.

75. Craterocephalus nouhuysi (Weber), 1910.

ATHERINICHTHYS NOUHUYSI Weber, *Notes Leyden Mus.*, **32**, 229, 1910; *Nova Guinea*, **9**, 555, fig. 26, 1913; Regan, *Trans. Zool. Soc. London*, **20**, 276, 1914.

Type-locality.—Lorentz River, New Guinea.

Range.—Streams of northern New Guinea.

76. Craterocephalus esox (Klunzinger), 1872.

ATHERINICHTHYS ESOX Klunzinger, *Arch. Naturg.*, **38**, 34, 1872; *Sitzb. Akad. Wiss. Wien*, **80**, 394, 1880.

Type-locality.—Port Philip, Australia.

Range.—Known only from the type-locality.

77. Craterocephalus jacksonianus (Quoy and Gaimard), 1824.

ATHERINA JACKSONIANA Quoy and Gaimard, *Voy. Uranie, Zool.*, 333, 1824; Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 461, 1835.

ATHERINICHTHYS JACKSONIANA Günther, *Catalogue Fishes Brit. Mus.* **3,** 402, 1861.
CHIROSTOMA JACKSONIANA Waite, *Mem. N. S. Wales Nat. Club,* **2,** 21, 1904.
Type-locality.—Port Jackson, New South Wales.
Range.—Shores (or streams) of eastern Australia and Tasmania (Günther).

XIX. ISO Jordan and Starks, 1906.

TROPIDOSTETHUS Ogilby, *Proc. Linn. Soc. N. S. Wales,* **20,** 322, 1895; Waite, *Rec. Austral. Mus.,* **5,** 234, 1904 (preoccupied by TROPIDOSTETHUS Phillippi, 1863).
Haplotype.—TROPIDOSTETHUS RHOTHOPHILUS Ogilby.
ISO Jordan and Starks, *Proc. U. S. Nat. Mus.,* **24,** 204, 1901.
Haplotype.—ISO FLOS-MARIS Jordan and Starks.
Range.—Surf of Japan and Australia.

This genus is the most specialized in the subfamily. It is an obvious derivative of ATHERINA, however. From that genus it differs in the following respects: the sharply compressed body, deep at the shoulder and contracted to a fleshy keel along the edge of the belly; the deep, short head, truncated posteriorly; the long anal fin, of 23 to 27 rays; the support of the juncture of the pubic bone with the ventral fin by a strengthened rib; the increased width of the lateral band, and especially the absence of scales on the head and the fore-part of the trunk dorsally and ventrally.

78. Iso rhothophilus (Ogilby), 1895.[St.]

TROPIDOSTETHUS RHOTHOPHILUS Ogilby, *Proc. Linn. Soc. N. S. Wales,* **20,** 322, 1895; Waite, *Rec. Austral. Mus.,* **5,** 234, pl. 25, fig. 2, 1904.
ISO RHOTHOPHILUS Waite, *Mem. N. S. Wales Nat. Club,* **2,** 21, 1904.
Type-locality.—Maroubra Bay, between Port Jackson and Botany Heads, near Sydney, Australia.
Range.—Surf of the eastern Australian shore.

79. Iso flos-maris Jordan and Starks, 1901.[St.]

(Plate III, Fig. 10)

ISO FLOS-MARIS Jordan and Starks, *Proc. U. S. Nat. Mus.,* **24,** 205, fig. 4, 1901.
Type-locality.—Enoshima, Misaki, Hada, Yoga and Hashigo, Japan.
Range.—Shores of southern Japan, in the surf.

Upon comparison of typical material, we find that ISO FLOS-MARIS is quite distinct from the Australian species. It differs in the more slender body, the depth being contained 4.2 to 5.0 instead of 3.5 to 4.0 times in the length without caudal; in the less anterior position of the anus, which is a little nearer the base of the caudal than the tip of the snout, rather than the reverse; in the consequently longer abdominal region, with a higher percentage of the vertebræ abdominal (vertebræ 18 + 25 in ISO FLOS-MARIS, 15 + 28 or 29 in ISO RHOTHOPHILUS); in the smaller size of the scales, as indicated in the published figures of the two species, and in the wider lateral band, which is separated by one-half or two-thirds, instead of its entire, width, from the origin of the anal fin (in two paratypes of I. FLOS-MARIS from Hashigo, however, the

lateral band is no wider than in I. RHOTHOPHILUS). These marked differences being less striking than the numerous points of resemblance between them, we retain these two remarkable atherines in the same genus.

79. Iso natalensis Regan.

ISO NATALENSIS Regan, *Ann. Durban Mus.*, **2**, 200, 1919. (Durban, Natal.)

Subfamily ATHERINOPSINÆ Fowler.

ATHERININÆ Fowler, *Proc. Acad. Nat. Sci. Phila.*, **40**, 727, 1904 (in part).
ATHERINOPSINÆ Fowler, *l. c.*, 737.

This large subfamily is restricted to the two shores of America, and includes all of the American species of the family, excepting a few of ATHERINA and HEPSETIA. Several of the genera are largely or wholly composed of fresh-water species.

Excepting the lack of vomerine teeth, the genus MENIDIA, especially the subgenus ISCHNOMEMBRAS, possesses all of the characters which one would postulate the ancestral type of this group to have. This point is emphasized in the analytical key to the genera. From some MENIDIA-like form several distinct lines of evolution may be traced to aberrant genera. THYRINA, ARCHOMENIDIA, and CHIROSTOMA, Mexican fresh-water genera, are derivable from such a fish. THYRINOPS, considerably resembling THYRINA, leads to the aberrant ATHERINELLA; the remarkable genus EURYSTOLE, convergent toward the unrelated genus ISO of the ATHERININÆ, also shows points of resemblance to THYRINA. HUBBESIA and MEMBRAS, and also LEURESTHES and even LABIDESTHES, are other modifications of the MENIDIA type. From MENIDIA likewise, the large species of temperate South America, belonging to AUSTROMENIDIA and related genera, have doubtless been derived. The highly peculiar fresh-water XENATHERINA was apparently also derived from a fish like MENIDIA or THYRINA, but the intermediate stages are unknown, and probably extinct. The other genera of the group agree in having the premaxillaries non-protractile; they form the subfamily ATHERINOPSINÆ as defined by Fowler. We are not certain, however, that the North American genera of this type, namely ATHERINOPSIS and ATHERINOPS, have had acommon origin with those of South America (BASILICHTHYS). It is fully evident, however, that all belong to the MENIDIA group of genera. For this entire group we use the only subfamily name that has been proposed—ATHERINOPSINÆ.

We are unable to place generically two American species, the descriptions being incomplete and probably inaccurate in detail. ATHERINA MICROPS Poey [15] from Cuba was accepted as a true ATHERINA by

[15] *Mem. Hist. Nat. Cuba*, **2**, 266, 1861.

Jordan and Evermann.[16] This disposition of the species, however, is excluded by Poey's statement that the anus is quite close to the anal fin. This character, as well as the small size of the mouth and the fin-formula, indicates that the species should be placed in the ATHERINOPSINÆ, but in what particular genus, the description does not indicate. The other species we fail to locate generically is ATHERINA INCISA Jenyns,[17] from the east coast of South America (39° S., 61° W.).

XX. MENIDIA Bonaparte, 1837.

MENIDIA Bonaparte, *Fauna Italica,* 1837,[18] fasc. 91; no pagination; Jordan and Gilbert, *Bull. U. S. Nat. Mus.,* **16,** 406, 1883; Jordan and Evermann, *ibid.,* **47,** pt. 1, 796, 1896; Kendall, *Rept. U. S. Fish Comm.,* 241, 1901 (1902); Jordan, *Copeia,* No. 32, 47, 1916.

Logotype.—ATHERINA MENIDIA Linnæus (by tautonomy).

ARGYREA DeKay, *New York Fauna,* **4,** 141, 1842 (preoccupied).

Logotype.—ATHERINA NOTATA Mitchill.

ISCHNOMEMBRAS Fowler, *Proc. Acad. Nat. Sci. Phila.,* **40,** 730, 1904; Fowler, *ibid.,* **56,** 256, 1919.

Orthotype.—ISCHNOMEMBRAS GABUNENSIS Fowler (= MENIDIA BERYLLINA (Cope)).

PHOXARGYREA Fowler, *l. c.,* 732.

Orthotype.—PHOXARGYREA DAYI Fowler (= MENIDIA MENIDIA NOTATA Mitchill).

Range.—Atlantic coast and coastwise streams from southern Canada to Florida and Louisiana; Gulf of California.

In restricted sense, MENIDIA may be defined as follows. Premaxillaries widely dilated posteriorly, not bound to snout by frenum; gape arched, restricted by fold of membrane between jaws; mouth not low, its front on a level with middle of eye; mouth moderate in size, the maxillary reaching nearly to front of eye; jaws equal, not produced into a beak; lower jaw only moderately oblique, its posterior end not strongly entering profile of head; teeth in two irregular series or a narrow band on the jaws, those of the inner premaxillary series and the outer mandibular series moderately enlarged. Body cavity rounded posteriorly, the air bladder not extended backward beyond vertical from origin of anal fin; anus normally located immediately before anal fin. Body slender, with both dorsal and ventral contours rather evenly curved; trunk in cross-section not cuneate, the belly being broadly rounded; head more or less compressed. Scales large, in 36 to 56 series; scale margins strictly entire; apical radii numerous and very fine, or obsolete, circuli developed on exposed field of scales. Dorsal and anal fins wholly scaleless. First

[16] *Bull. U. S. Nat. Mus.,* **47,** pt. 1, 791, 1896.

[17] ATHERINA INCISA Jenyns, *Zool. Beagle,* **4** *(Fish),* 77, pl. 16, fig. 2, 1842 (not of Kner). ATHERINICHTHYS INCISA Günther, *Catalogue Fishes Brit. Mus.,* **3,** 405, 1861.

[18] Troschel (*Archiv Naturgeschichte,* 1838) gives 1837 as the date of Bonaparte's account of Atherine fishes.

dorsal origin before or over origin of anal fin; second dorsal beginning a little before middle of anal base; anal fin beginning well before middle of length of body, excluding head and caudal fin; pectoral shorter than head, reaching past vertical from the insertion of ventral, which is as far from, or slightly farther from, the upper angle of the pectoral base than from the origin of the anal. Fishes of small size, attaining a length of three to six inches.

Subgenus ISCHNOMEMBRAS Fowler.

80. Menidia beryllina (Cope), 1866.[St.]

? ATHERINICHTHYS GRACILIS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 405, 1861.
MENIDIA GRACILIS Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 797, 1896.

CHIROSTOMA BERYLLINUM Cope, *Trans. Amer. Phil. Soc.*, 403, 1866.

This small MENIDIA of the east coast of the United States has been regarded as representing ATHERINICHTHYS GRACILIS Günther, but the inadequate description of that species, based upon a young specimen without data, does not conform with BERYLLINA. Until further evidence is forthcoming, therefore, we shall follow Kendall in not applying Günther's name to this species.

MENIDIA BERYLLINA, as we accept the species, is composed of two subspecies, the extremes of which are of very dissimilar appearance, though of similar technical characters. The one, PENINSULÆ, occurs in salt water along the coast of Florida and the Gulf States. It has a comparatively deep and strongly compressed body, with the ventral contour more strongly arched than the dorsal and a large head with a rather small eye and a sharp snout. The other form, BERYLLINA, is abundant along the coast and coastwise streams of the Atlantic seaboard of the United States, and also in the fresh waters of Florida and the lower Mississippi Valley. The two intergrade in Florida, according to Kendall, but the inter-relationships of the two forms are yet to be accurately determined. Perhaps they are specifically distinct.

80a. Menidia beryllina peninsulæ (Goode and Bean), 1879.[St.]

(Plate III, Fig. 11)

CHIROSTOMA PENINSULÆ Goode and Bean, *Proc. U. S. Nat. Mus.*, **2**, 148, 150, 1879 (exclusive of specimens from Lake Monroe).

MENIDIA PENINSULÆ Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **5**, 266, 1882; *Bull. U. S. Nat. Mus.*, **16**, 408, 1883; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 797, 1896; **4**, pl. 124, fig. 337, 1900 (figure poor); Kendall, *Rept. U. S. Fish Comm.*, 64, 1899; 257, 1901 (1902), text fig.; Cockerell, *Proc. Biol. Soc. Wash.*, **23**, 48, 1910.

Type-locality.—Pensacola, Florida.

Range.—Coasts of Florida and the Gulf States, so far as known confined to salt water.

The description and figures of Kendall indicate very well the distinctive features of this form. Among other specimens form Florida in the Field Museum, those from Punta Rossa, Boca Grande, Fort Myers, and Captive Pass may be placed on record.

80b. Menidia beryllina beryllina (Cope), 1866.[St.]

(Plate III, Fig. 12)

CHIROSTOMA BERYLLINUM Cope, *Trans. Amer. Phil. Soc.*, 403, 1866.

MENIDIA BERYLLINA Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 408, 1883; Kendall, *Rept. U. S. Fish. Comm.*, 260, 1901 (1902), text figure.

MENIDIA GRACILIS BERYLLINA Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 797, 1896; **4**, pl. 124, fig. 338, 1900 (figure rather poor). (Also of various authors in local lists).

Type-locality.—Potomac River, near Washington.

MENIDIA GRACILIS Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 797, 1896 (apparently not ATHERINICHTHYS GRACILIS Günther).

MENIDIA AUDENS Hay, *Bull. U. S. Fish Comm.*, **2**, 64, 1882; Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 908, 1883; Jordan and Evermann, *ibid.*, **47**, pt. 1, 798, 1896; Kendall, *Rept. U. S. Fish Comm.*, 259, 1901 (1902); Nichols, *Bull. Amer. Mus. Nat. Hist*, **30**, 276, 1911.

Type-locality.—Memphis, on the lower Mississippi River (now definitely restricted).

MENIDIA PENINSULÆ ATRIMENTIS Kendall, *Rept. U. S. Fish Comm.*, 258, 1901 (1902), text figure.

Type-locality.—South Lake, Titusville, Florida.

MENIDIA BERYLLINA CEREA Kendall, *l. c.*, 261, text figure; Fowler, *Ann. Rept. New Jersey State Mus.*, 215, 1905 (1906); 288, 1906 (1907), text figure; Smith, *N. Car. Geol. Econ. Surv.*, **2**, 177, fig. 70, 1907.

Type-locality.—Waquoit Bay, Massachusetts.

ISCHNOMEMBRAS GABUNENSIS Fowler, *Proc. Acad. Nat. Sci. Phila.*, **40**, 731, pl. 42, 1904, upper figure.

ATHERINA GABONENSIS Boulenger, *Ann. Mag. Nat. Hist.* (7), **16**, 52, 1906; *Catalogue Fresh-water Fishes Africa*, **4**, 76, 1916.

Type-locality.—"Gabun River, Gabun Country, West Africa" (presumably an error).

Range.—Coast and coastwise streams from New England to South Carolina; fresh waters of Florida ("ATRIMENTIS") and the lower Mississippi Valley ("AUDENS").

After carefully comparing the paratype of ISCHNOMEMBRAS GABUNENSIS, stated to have been taken in West Africa, with specimens of M. B. BERYLLINA, we have come to the conclusion that the two are identical. The type-locality of ISCHONOMEMBRAS GABUNENSIS is very probably incorrect. Dr. Boulenger's reference of GABUNENSIS to ATHERINA, as well as his altering of the spelling of the word was, of course, unjustified.

Mr. Nichols in 1911 compared specimens of a MENIDIA from Moon Lake, Mississippi, with examples of MENIDIA "GRACILIS" from Long Island. Being unable to detect specific differences, he regarded AUDENS

as a synonym of GRACILIS (=BERYLLINA). Similarly we are unable to distinguish clearly between paratypes of ATRIMENTIS from Lake Monroe, Florida, and a specimen of BERYLLINA from Noank, Connecticut. In both lots the eye is scarcely longer than the snout, and the base of the anal fin is a little shorter than the head. Specimens from Brown's Creek, Long Island, supposedly typical of M. B. CEREA, also have the anal shorter than the head.

MENIDIA BERYLLINA BERYLLINA typically differs from M. B. PENINSULÆ in the more slender, more nearly terete body; in the shorter, blunter snout; in the somewhat longer anal fin, and in the waxy, rather than greenish, color. The color of PENINSULÆ does not appear to be constant, and in the form of the head and snout the extreme type CEREA of the New England coast grades into (or at least toward) PENINSULÆ through typical BERYLLINA of the fresh waters of the Middle Atlantic States, and ATRIMENTIS of the fresh waters of Florida.

Subgenus MENIDIA Bonaparte.

81. **Menidia sardina** (Jenkins and Evermann), 1888.

ATHERINA SARDINA Jenkins and Evermann, *Proc. U. S. Nat. Mus.*, **11**, 137, 1888 (1889).

MENIDIA SARDINA Evermann and Jenkins, *ibid.*, **14**, 136, 1891; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 799, 1896.

Type-locality.—Guaymas, Sonora.

Range.—Gulf of California.

This species seems to be the Pacific analogue of MENIDIA M. NOTATA.

82. **Menidia clara** Evermann and Jenkins, 1891.

MENIDIA CLARA Evermann and Jenkins, *Proc. U. S. Nat. Mus.*, **14**, 136, 1891; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 801, 1896.

Type-locality.—Guaymas, Sonora.

Range.—Gulf of California.

In the reduced size of the teeth and of the scales, this species seems to approach LEURESTHES. It should perhaps be made the type of a distinct subgenus or genus.

83. **Menidia menidia** (Linnæus), 1766.[St.]

Jordan and Evermann,[19] Kendall,[20] Nichols,[21] Smith,[22] and Hubbs[23] have demonstrated that this species comprises two intergrading subspecies, MENIDIA and NOTATA. The intergrades appear like hybrids, in

[19] *Bull. U. S. Nat. Mus.*, **47**, pt. 3, 2840, 1898.

[20] *Rept. U. S. Fish Comm.*, 261-267, 1901 (1902).

[21] *Amer. Nat.*, **42**, 731, 1908.

[22] *N. Car. Geol. Econ. Surv.*, **2**, 176, 1907.

[23] *Bull. Mus. Nat. Hist.*, **38**, 415, 1918 (footnote).

that they frequently possess characters of both forms combined in a single individual.

The Field Museum has material of M. MENIDIA MENIDIA from South Carolina; intergrades between MENIDIA and NOTATA from Beaufort, North Carolina, from Ocean View, Virginia, and Ocean City, New Jersey, and examples of M. MENIDIA NOTATA from off Swan River, Long Island, from Noank, Connecticut, and from Woods Hole and Waquoit Bay, Massachusetts.

83a. Menidia menidia notata (Mitchill), 1815.[St.]

(Plate IV, Fig. 14.)

ATHERINA NOTATA Mitchill, *Trans. Lit. Phil. Soc. New York,* **1,** 446, 1815; De Kay, *New York Fauna,* **4,** 141, pl. 28, fig. 88, 1842.

Type-locality.—New York.

ATHERINOPSIS NOTATUS Baird, *Ann. Rept. Smiths. Inst.,* 338, 1854.

ATHERINICHTHYS NOTATA Günther, *Catalogue Fishes Brit. Mus.,* **3,** 406, 1861.

ARGYREA NOTATA Abbott, *Geol. N. Jer.,* 816, 1868.

MENIDIA NOTATA Jordan and Gilbert, *Bull. U. S. Nat. Mus.,* **16,** 407, 1883; Jordan and Evermann, *ibid.,* **47,** pt. 1, 800, 18906.

MENIDIA MENIDIA NOTATA Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 3, 2840, 1898; Kendall, *Rept. U. S. Fish Comm.,* 262-267, 1901 (1902), text figure; Fowler, *Rept. N. Jer. State Mus.,* 216, 1905 (1906), text figure; 289, 1906 (1907).

Type-locality.—New York.

ATHERINA VIRIDESCENS Mitchill, *Trans. Lit. Phil. Soc. New York,* **1,** 447, 1815.

Type-locality.—New York, New York.

PHOXARGYREA DAYI Fowler, *Proc. Acad. Nat. Sci. Phila.,* **40,** 732, pl. 41, 1904, lower figure.

Type-locality.—India (doubtless by error).

Range.—Coast of eastern North America from Nova Scotia to Cape May, intergrading southward with M. M. MENIDIA.

83b. Menidia menidia menidia (Linnæus), 1766.[St.]

We find no reason to doubt that PHOXARGYREA is identical with MENIDIA. As the entire MENIDIA group of genera (the ATHERINOPSINÆ) is American, we are led to believe that the label with the type of PHOXARGYREA, reading "R. Coates, India," has been transferred accidentally from some other specimen. The description of P. DAYI, in fact, fits young examples of M. M. NOTATA in all important specific characters.

ATHERINA MENIDIA Linnæus, *Syst. Nat.,* ed. 12, **1,** 519, 1766; Lacépède, *Hist Nat. Poiss.,* **5,** 371.

ATHERINICHTHYS MENIDIA Günther, *Catalogue Fishes Brit. Mus.,* **3,** 406, 1861.

CHIROSTOMA MENIDIUM Jordan and Gilbert, *Proc. U. S. Nat. Mus.,* **1,** 383, 1878 (in part).

MENIDIA MENIDIA Jordan and Evermann, *Bull U. S. Nat. Mus.,* **47,** pt. 1, 800, 1896.

MENIDIA MENIDIA MENIDIA Kendall, *Rept. U. S. Fish Comm.,* 262-267, 1901 (1902) text figure.

Type-locality.—Charleston, South Carolina.

ATHERINA BOSCII Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 465, 1835; Jordan, *Proc. U. S. Nat. Mus.*, **9**, 530, 1886.

MENIDIA BOSCI Jordan and Gilbert, *Bull U. S. Nat. Mus.*, **16**, 407, 1883 (synonymy only).

Type-locality.—Charleston.

MENIDIA DENTEX Goode and Bean, *Proc. U. S. Nat. Mus.*, **5**, 429, 1882.

Type-locality.—Mouth of St. John's River, Florida.

MENIDIA BRASILIENSIS Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 408, 1883 (exclusive of synonymy).

Range.—Coast of Florida and South Carolina, intergrading northward with M. M. NOTATA.

XXI. ARCHOMENIDIA Jordan and Hubbs, 1919.

ARCHOMENIDIA Jordan and Hubbs, new genus.

Orthotype.—ATHERINICHTHYS SALLEI Regan.

Range.—East coast streams of Mexico.

ARCHOMENIDIA agrees with the diagnosis of MENIDIA given above in all respects but the following. Anus advanced in position, located midway between insertion of ventral fin and origin of anal fin; air bladder extended backward to beyond middle of base of anal fin. Gape very strongly arched; lower jaw included; teeth in two series in both jaws, those of the outer premaxillary series enlarged, becoming canine-like anteriorly, and directed forward and downward. Circuli obsolete on exposed field of scales. In some respects ARCHOMENIDIA approaches THYRINA more closely than MENIDIA. It differs from that genus in the position of the anus; in the more backward extension of the air bladder, and in details of fin, mouth, and teeth characters.

84. Archomenidia sallei (Regan), 1903.*St.*

ATHERINICHTHYS BRASILIENSIS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 404, 1861 (the specimen from Mexico only, subsequently described by Regan as A. SALLEI).

ATHERINICHTHYS SALLEI Regan, *Proc. Zool. Soc. London*, pt. 2, 60, 1903.

MENIDIA SALLEI Meek, *Publ. Field Mus. (Zool.)* **5**, 181, 1904 (after Regan).

Type-locality.—"Mexico."

MENIDIA LISA Meek, *ibid.*, 182 (specimens from El Hule only).

Range.—East coast streams of central Mexico.

The history of this species has been largely that of a single specimen, collected by Sallé in Mexico. It was first recorded by Günther as ATHERINICHTHYS BRASILIENSIS (a record which has caused considerable confusion in the literature), and finally described as a new species, SALLEI, by Regan, under the obsolete generic name ATHERINICHTHYS. Dr. Meek referred SALLEI to MENIDIA, but failed to note that his specimens from El Hule, Vera Cruz, Mexico, were different from the type of his MENIDIA LISA. There is at hand a series from the Rio Hueyapam, at the village of San Juan, Acayucan, Mexico, collected by A. G. Ruthven

and H. B. Baker July 23, 1910. This material fixes the hitherto imperfectly known habitat of this species as the east coast streams of central Mexico, and makes possible a supplementary description of the species (based upon seven specimens 41 to 55 mm. long to caudal).

Body rather slender and moderately compressed, resembling that of MENIDIA M. MENIDIA in lateral aspect, except that the anterodorsal contour is more nearly horizontal; belly broadly rounded anteroventrally; greatest depth contained 4.9 to 5.3 times in total length to caudal; least depth of caudal peduncle, 2.8 to 3.0 times in length of head (including the opercular membrane). Length of head contained from 4.0 to 4.3 times in the length to caudal; head a little less than half as broad as long, and not quite so broad as deep. Length of orbit a little greater than the width of the slightly convex interorbital, notably greater than length of snout, slightly greater than postorbital length of head, and contained 2.6 to 2.7 times in head. Premaxillary widely dilated posteriorly; the strongly oblique maxillary extended backward not quite to below the anterior orbital margin; the tip of the lower jaw included; the gape very strongly arched, the physiognomy approaching that of CYNOLEBIAS (PŒCILIIDÆ). Teeth of the outer of the two rows in both jaws decidedly stronger and more regularly arranged than those of the inner series; the outer premaxillary teeth exposed, and visible from above when the mouth is closed, they being directed outward as well as downward; those toward the front of the premaxillaries becoming strongly curved canines.

Anus advanced in position, as in no other known species of the subfamily, located about midway between the insertion of the ventral fin and the origin of the anal, nearer tip of snout than caudal base. Ventral insertion equidistant from anal fin and from head; origin of the anal a little more distant from the tip of the snout than from the end of the middle caudal rays; origin of the first dorsal over, slightly before, or slightly behind the anal origin; distance between the origins of the two dorsals considerably less than twice the length of the first dorsal when depressed, longer than the base of the second dorsal, and about as long as head behind middle of eye; second dorsal beginning over middle of anal base, higher than long, falcate like the anal; anterior and highest anal rays as high as the body; length of anal base a little greater than length of head; the ventrals when folded together concealing the anus, but not reaching the anal. Fin rays; dorsal, IV or V—I, 9 or I, 10; anal, I, 18 to I, 20.

Scales in 40 to 42 series from branchial aperture to end of hypural, in 10 series (8 main rows) above anal origin; in 7 series between origins of dorsal fins. Scale margins evenly rounded or broadly and shallow-

ly undulate, not crenate; radii and circuli obsolete on exposed field of scales.

Coloration of preserved specimens moderately dark, with a silvery lateral band about as wide as a scale, and disappearing anteriorly. Tips of vertical fins dark.

XXII. HUBBESIA Jordan, 1919.

HUBBESIA Jordan, *Proc. U. S. Nat. Mus.*, 310, 1919.
Orthotype.—MENIDIA GILBERTI Jordan and Bollman.
Range.—Tropical Pacific, in the Panama region.

This well marked genus includes a single species, related most closely to those of MENIDIA and MEMBRAS. Like THYRINOPS of the same region, its scales are sculptured by apical radii, but in that genus the radii are much finer and more numerous.

85. Hubbesia gilberti (Jordan and Bollman), 1889.[St.]

(Plate IV, Fig. 15)

MENIDIA GILBERTI Jordan and Bollman, *Proc. U. S. Nat. Mus.*, **12**, 155, 1889; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 798, 1896.
KIRTLANDIA GILBERTI Gilbert and Starks, *Mem. Cal. Acad. Sci.*, **4**, 58, 1904.
HUBBESIA GILBERTI, Jordan, *l. c.*, **55**, 310, fig. 2.
Type-locality.—Panama.
Range.—Panama Bay.

XXIII. MEMBRAS Bonaparte, 1837.

MEMBRAS Bonaparte, *Fauna Italica*, 1837, fasc. 91, no pagination; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 789, 1896 (MEMBRAS referred to ATHERINA); Jordan, *Copeia*, No. 32, 47, 1916 (ATHERINA MOCHON incorrectly designated as type of genus).
Orthotype.—ATHERINA MARTINICA Cuvier and Valenciennes (by reference).
KIRTLANDIA Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 794, 1896.
Orthotype.—CHIROSTOMA VAGRANS Goode and Bean.
Range.—Tropical Atlantic shores of America, north to New York.

The genus MEMBRAS was defined by Bonaparte, but without mention of a type in connection with the description. In referring MEMBRAS to ATHERINA, Jordan and Evermann overlooked the fact that farther on in the same work Bonaparte explained that the two genera, MENIDIA and MEMBRAS, were based on exotic species and that they corresponded to two sections of ATHERINA, indicated but not named by Valenciennes. MEMBRAS, therefore, rests on a species allied to our genus KIRTLANDIA, which name it may be taken to replace. Our notes on the type of ATHERINA MARTINICA in Paris indicate that its fins are naked. It is therefore possible that the genus KIRTLANDIA, characterized by its scaly fins, may be distinct from MEMBRAS. These scales on the fins are deciduous, however, and may have been present originally on the type of A. MARTINICA.

86. Membras martinicus Cuvier and Valenciennes, 1835.

ATHERINA MARTINICA Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10,** 459, 1835.
MENIDIA MARTINICA Jordan, *Proc. U. S. Nat. Mus.* **9,** 530, 1886 (redescription of type).
KIRTLANDIA MARTINICA Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47,** pt. 1, 795, 1896.
Type-locality.—Martinique.
Range.—Known only from the type locality.

This species is known only from the original types.

87. Membras vagrans vagrans (Goode and Bean), 1879.$^{St.}$

(Plate IV, Fig. 16)

CHIROSTOMA VAGRANS Goode and Bean, *Proc. U. S. Nat. Mus.*, **2,** 148, 1879,
MENIDIA VAGRANS Jordan and Gilbert, *ibid.*, **5,** 267, 1882; *Bull. U. S. Nat. Mus.*, **16,** 407, 1883 (in part).
KIRTLANDIA VAGRANS Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47,** pt. 1, 794; **4,** pl. 124, fig. 336, 1900 (figure inaccurate in certain details).
Type-locality.—Pensacola, Florida.
Range.—Gulf Coast of the United States, south to Tampico, Mexico.

Soft rays of second dorsal, 7 to 9; pectoral fins a little longer or a little shorter than head.

87a. Membras vagrans laciniatus (Swain), 1883.$^{St.}$

CHIROSTOMA MENIDIUM Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **1,** 383, 1878 (in part).
MENIDIA BOSCI Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16,** 407, 1883 (exclusive of references).
MENIDIA VAGRANS Jordan and Gilbert, *l. c.*, 407 (in part).
KIRTLANDIA VAGRANS Smith, *N. Car. Geol. Econ. Surv.*, **2,** 178, 1907.
MENIDIA VAGRANS LACINIATA Swain, in Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16,** 908, 1883.
MENIDIA LACINIATA Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **5,** 589, 1882 (1883).
KIRTLANDIA LACINIATA Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47,** pt. 1, 795, 1896; Cockerell, *Proc. Biol. Soc. Wash.*, **23,** 47, 1910.
KIRTLANDIA VAGRANS LACINIATA Fowler, *Ann. Rept. New Jersey State Mus.*, 213, 1905 (1906); 392, pl. 95, 1906 (1907).
Type-locality.—Coast of North Carolina (fixed as Beaufort, North Carolina, by Jordan and Evermann).
Range.—Atlantic coast of United States, from New York to South Carolina.

Dr. Hugh M. Smith in 1907 questioned the validity of LACINIATA, referring that form to the synonymy of VAGRANS. He does not state the evidence which led him to this conclusion, and we are unable to agree with him. In several specimens from the Rio Panuco at Tampico, Mexico, the scale rows vary from 42 to 45; in five from Cedar Keys, Florida, they vary from 45 to 47; in nine from Ocean View, Virginia, from 48 to 50; in five from Carson's Inlet, New Jersey, from 47 to 50. In the same lots the soft anal rays vary as follows:

Locality	Subspecies	Anal rays						
		15	16	17	18	19	20	21
Tampico, Mexico	VAGRANS	2	4	4	—	—	—	—
Cedar Keys, Florida	INTERGRADES	—	1	3	5	—	—	—
Ocean View, Virginia	LACINIATUS	—	—	—	2	1	3	3
Corson's Inlet, New Jersey	LACINIATUS	—	—	—	—	2	2	1

In a series of VAGRANS from Galveston, Texas, Jordan and Gilbert counted 14 to 17 soft anal rays. These figures indicate that VAGRANS and LACINIATUS intergrade, and should be regarded as subspecies.

XXIV. THYRINA Jordan and Culver, 1895.

THYRINA Jordan and Culver, *Proc. Cal. Acad. Sci.*, (2), **5**, 418, 1895; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 803, 1896; Regan, *Biol. Centr.-Amer., Pisces*, 63, 1907.

Orthotype.—THYRINA EVERMANNI Jordan and Culver.

MELANIRIS Meek, *Publ. Field Mus. (Zool.)*, **3**, 117, 1902.

Orthotype.—MELANIRIS BALSANUS Meek.

Range.—Coastwise districts from western Mexico (exclusive of the Rio Lerma system) and Central America, south to Colombia and Rio de Janeiro, Brazil; chiefly in fresh water.

THYRINA is very close to MENIDIA, which it represents in the regions named above. It differs from MENIDIA, as described in this paper, in several respects. Trunk region shortened, and sharply compressed ventrally, subcuneate in cross section; air-bladder extended backward into the urosome, as a widely rounded diverticulum, over the first third of the anal base, and visible through the translucent body wall. Lower jaw included; premaxillary teeth heterodont, the inner teeth in a narrow band or irregular series; the outer teeth uniserially arranged, and somewhat enlarged (less enlarged than in ARCHOMENIDIA, and not directed outward). Anterodorsal contour of body nearly straight, and nearly parallel with the posterodorsal contour, the form of the body resembling that of GAMBUSIA. Pectoral fin falcate, usually longer than head; first dorsal origin well behind origin of anal fin; anal base longer than head. Circuli as well as radii obsolescent on exposed field of scales; scale-margins frequently crenate, particularly on the back.

It seems almost certain to us that Mr. Regan has unduly reduced the number of species of THYRINA. After having examined all of the described species except GUATEMALENSIS, we are disposed to accept all as valid.

88. Thyrina meeki Miller, 1907.*St.*

THYRINA MEEKI Miller, *Bull. Amer. Mus. Nat. Hist.*, **23**, 110, fig. 2, 1907; Meek, *Publ. Field Mus. (Zool.)*, **7**, 139, 1907.

Type-locality.—Rio Motagua, at Gualan, Guatemala.

Range.—Motagua River and tributaries, on the Atlantic slope of Guatemala.

This species may be recognized at sight by its long snout. The upper margin of the rami of the mandibles is curved upward anteriorly, and but little elevated posteriorly.

89. Thyrina chagresi (Meek and Hildebrand), 1914.[St.]

MENIDIA CHAGRESI Meek and Hildebrand, *Publ. Field Mus. (Zool.)*, **10**, 119, 1914.
Type-locality.—Gorgona, Panama Canal Zone.
Range.—Streams of the Atlantic drainage of Panama and Costa Rica.

This species is a true THYRINA, most closely related to T. MEEKI and T. BRASILIENSIS. It differs from MEEKI in its shorter snout and larger eye, and in the deeper base of the mandibular rami, and from BRASILIENSIS in the shorter head, more posterior first dorsal, more compressed belly, etc.

90. Thyrina brasiliensis (Quoy and Gaimard), 1824.[St.]

ATHERINA BRASILIENSIS Quoy and Gaimard, *Voy. Uranie, Poissons*, 332, 1824; Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 467, 1835.
ATHERINICHTHYS BRASILIENSIS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 404, 1861 (exclusive of Mexico record); Regan, *Proc. Zool. Soc. London*, 60, 1903.
[BASILICHTHYS] BRASILIENSIS Girard, *U. S. Nav. Astron. Exp.*, **2**, 238, 1860.
MENIDIA BRASILIENSIS Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 408, 1883 (reference only); Starks, *The Fishes of the Stanford Expedition to Brazil (Stanford University)*, 41, 1913; Ribeiro, *Rev. Mus. Pal.*, **10**, 764, 1918; *Arch. Mus. Nac. Rio de Janeiro*, **17**, *Trematolepides*, 12, 1915 (exclusive of Mexico record).
CHIROSTOMA BRASILIENSE Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 794, 1896.
Type-locality.—Rio de Janeiro, Brazil.
ATHERINA MACROPHTHALMA Agassiz, *Pisc. Brazil*, 136, pl. 47, fig. 1, 1829.
[BASILICHTHYS] MACROPHTHALMA Girard, *U. S. Nav. Astron. Exp.*, **2**, 238, 1860.
Type-locality.—Rio de Janeiro, Brazil.
Range.—Salt and brackish waters of South America from Rio de Janeiro to Lake Maracaibo.

In this species the upper jaw is longer than the lower, being slightly hooked over it, and the outer premaxillary teeth are enlarged; the first dorsal origin lies slightly behind the vertical from the origin of the anal; the body is strongly compressed; the body cavity is broadly rounded posteriorly, and the air bladder is but slightly produced into the tail; the scales show bare traces of numerous fine apical radii and marginal crenulations; the eye is longer than the snout in the young, shorter than the snout in the adult. The largest specimen examined is a mature female 113 mm. long to caudal. Two specimens, 37 and 41 mm. long to caudal, the first to be recorded north of Brazil, were collected by Mr. W. H. Osgood in Lake Maracaibo, Venezuela.

91. Thyrina sardina (Meek), 1907.[St.]

CHIROSTOMA GUATEMALENSIS Gill and Bransford, *Proc. Acad. Nat. Sci. Phila.*, 187, 1877.

THYRINA GUATEMALENSIS Fowler, *ibid.*, **40**, 736, pl. 43, 1904, lower figure (apparently not ATHERINICHTHYS GUATEMALENSIS Günther).

MELANIRIS SARDINA Meek, *Publ. Field Mus., (Zool.)*, **7**, 114, 1907.

THYRINA SARDINA Regan, *Biol. Centr.-Amer., Pisces*, 189, 1908.

Type-locality.—Lake Managua, Nicaragua.

Range.—Lakes Nicaragua and Managua, Nicaragua.

THYRINA SARDINA has the mouth more oblique than the other species of the genus, and the rami of the lower jaw are much more elevated within the mouth, forming an apical angle which is scarcely obtuse.

If it should be found necessary to merge THYRINA with MENIDIA, then this species would require a new name, there being a prior MENIDIA SARDINA.

92. Thyrina guatemalensis (Günther), 1864.

ATHERINICHTHYS GUATEMALENSIS Günther, *Proc. Zool. Soc. London*, 151, 1864; *Trans. Zool. Soc. London*, **6**, 443, 1869.

MENIDIA GUATEMALENSIS Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 801, 1896.

THYRINA GUATEMALENSIS Jordan and Evermann, *l. c.*, pt. 3, 2840, 1898; Regan, *Biol. Centr.-Amer., Pisces*, 64, 1907 (in part); *? Ann. Mag. Nat. Hist* (8), **12**, 472, 1913 (Rio Condoto, Pacific slope of Colombia).

Type-locality.—Lakes of Huamuchal, Pacific slope of Guatemala.

Range.—Pacific slope of Guatemala, ? southward to Colombia.

93. Thyrina balsana (Meek), 1902.[St.]

(Plate IV, Fig. 17)

MELANIRIS BALSANUS Meek, *Publ. Field Mus. (Zool.)*, **3**, 117, pl. 28, 1902; **5**, 183, fig. 64, 1904; Jordan, *Guide to the Study of Fishes*, **2**, 218, 1905.

(Plate V, Fig. 17)

Type-locality.—Rio Balsas, at Balsas, Guerrero, Mexico.

THYRINA GUATEMALENSIS Regan, *Biol. Centr.-Amer., Pisces*, 64, 1907 (in part).

Range.—Streams of the Balsas Basin, Mexico.

This species and SARDINA, which Dr. Meek referred to his genus MELANIRIS, agree with the type of THYRINA (EVERMANNI) in all essential respects. In both of these species the belly is apparently compressed as though pinched into that form, but the abdomen is distended with mature eggs in the specimens at hand.

T. BALSANA is very closely related to GUATEMALENSIS, EVERMANNI, and CRYSTALLINA. We have no specimens of GUATEMALENSIS at hand, and Günther's description is incomplete. The only point of difference apparent lies in the size of the scales: in ten paratypes of BALSANA there are 38 to 40—9 or 10 rows, while Günther counted 36-7 in GUATEMALENSIS. T. BALSANA differs from EVERMANNI in the less sharply com-

pressed belly, in the somewhat shorter and less pointed and less falcate pectoral, and in the shorter anal fin; in EVERMANNI there are 22 to 25 soft anal rays; in twelve specimens of BALSANUS, 18 to 23. T. BALSANA is more closely related to CRYSTALLINA, but has the head usually longer, the depth less, the pectoral fin slightly shorter, and the eye smaller. Greatest depth of body in mature females, somewhat less than one-fifth the total length to caudal; head, 4.0 to 4.4 (4.3 to 4.5 in adults of CRYSTALLINA); pectoral as long as head, or slightly shorter or slightly longer; eye of adult, less than one-third length of head. There are either three or four spines in the first dorsal. The rami of the lower jaw are scarcely elevated posteriorly, and the gape of the mouth is little restricted posteriorly.

94. **Thyrina crystallina** Jordan and Culver, 1895.[St.]

THYRINA CRYSTALLINA Jordan and Culver, *Proc. Cal. Acad. Sci.* (2), **5,** 420, 1895; Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 1, 804, 1896; Meek, *Publ. Field Mus. (Zool.),* **5,** 184, 1904.

Type-locality.—Lower course of the Rio Presidio, near Mazatlan.

THYRINA GUATEMALENSIS Regan, *Biol. Centr.-Amer., Pisces,* 64, 1907 (in part).

Range.—Fresh waters of the Rio Presidio (Rio Mazatlan), Mexico.

The characters regarded as diagnostic in the distinction of this species from EVERMANNI, though not wholly constant, are yet probably of taxonomic significance. For example, the soft anal rays in the types of CRYSTALLINA vary from 19 to 23, in the types of EVERMANNI from 22 to 25.

95. **Thyrina evermanni** Jordan and Culver, 1895.[St.]

(Plate V, Fig. 18)

THYRINA EVERMANNI Jordan and Culver, *Proc. Cal. Acad. Sci.* (2), **5,** 419, pl. 33, 1895; Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 1, 804, 1896; **4,** pl. 125, fig. 340, 1900; Meek, *Publ. Field Mus. (Zool.),* **5,** 184, 1904.

Type-locality.—Estuary of the Rio Presidio at Mazatlan, Mexico.

THYRINA GUATEMALENSIS Regan, *Biol. Centr.-Amer., Pisces,* 64, 1907 (in part).

Range.—Estuary of the Rio Presidio, Pacific slope of Mexico.

XXV. THYRINOPS Hubbs, 1918.

THYRINOPS Hubbs, *Proc. Acad. Nat. Sci. Phila.,* **69,** 306, 1918.

Orthotype.—ATHERINICHTHYS PACHYLEPIS Günther.

Range.—Shores of the Panamaic Province.

This genus contains a single known species, intermediate in most respects between THYRINA and ATHERINELLA, as indicated in the key to the genera. As in THYRINA, the air bladder, showing through the translucent flesh and scales, extends broadly backward a short distance into the urosome.

96. Thyrinops pachylepis (Günther), 1864.[St.]

ATHERINICHTHYS PACHYLEPIS Günther, *Proc. Zool. Soc. London,* 25, 1864; *Trans. Zool. Soc. London,* **6,** 443, 1869.

MENIDIA PACHYLEPIS Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 1, 801, 1896.

[THYRINA] PACHYLEPIS Jordan and Evermann, *ibid.,* pt. 3, 2840, 1898.

KIRTLANDIA PACHYLEPIS Gilbert and Starks, *Mem. Cal. Acad. Sci.,* **4,** 57, 1904; Starks, *Proc. U. S. Nat. Mus.,* **30,** 783, 1906.

THYRINA PACHYLEPIS Regan, *Biol. Centr.-Amer., Pisces,* 64, 1907.

THYRINOPS PACHYLEPIS Hubbs, *Proc. Acad. Nat. Sci. Phila.,* **69,** 307, 1918.

Type-locality.—Panama.

Range.—Costa Rica to Ecuador.

XXVI. ATHERINELLA Steindachner, 1875.

ATHERINELLA Steindachner, *Sitzb. Akad. Wiss. Wien,* **71,** 477, 1875.

Orthotype.—ATHERINELLA PANAMENSIS Steindachner.

Range.—Panamaic Province.

ATHERINELLA is related to THYRINOPS and THYRINA, but is much more aberrant than either; in fact, it is one of the most aberrant genera of the ATHERINIDÆ, being characterized by extreme features. The belly throughout is carinate, not merely sharply compressed; the rami of the lower jaw are more elevated than in any other genus of the subfamily; the scales are strongly dentate; both dorsal fins are more posteriorly inserted than in any other member of the family; the first being over the middle of the anal base.

97. Atherinella panamensis Steindachner, 1875.[St.]

ATHERINELLA PANAMENSIS Steindachner, *Sitzb. Akad. Wiss. Wein,* **71,** 477, 1875; Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 1, 805, 1896; Gilbert and Starks, *Mem. Cal. Acad. Sci.,* **4,** 59, pl. 9, fig. 17, 1904.

Type-locality.—Panama.

Range.—Panama Bay.

XXVII. EURYSTOLE Jordan and Evermann, 1896.

EURYSTOLE Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 1, 802, 1896.

Orthotype.—ATHERINELLA ERIARCHA Jordan and Gilbert.

Range.—Pacific shores of tropical America.

In its sharply compressed body, deep and abruptly truncated head, convex interorbital, and very wide lateral band, EURYSTOLE is remarkably convergent toward ISO, a genus of the ATHERININÆ inhabiting the western shores of the Pacific. In these characters, EURYSTOLE differs from all other genera of the subfamily ATHERINOPSINÆ to which it belongs. From all the ATHERINIDÆ it is distinguished by the development of a weak spine, closely appressed to the head, at the angle of the preopercular ridge. EURYSTOLE seems to be at least remotely related

to THYRINA, which it resembles in the trenchant edge of the short belly, the anterior origin of the long anal fin, and in the slender rami of the lower jaw.

98. Eurystole eriarcha (Jordan and Gilbert), 1881.*St.*

(Plate V, Fig. 19)

ATHERINELLA ERIARCHA Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **4**, 348, 1881.

EURYSTOLE ERIARCHA Jordan, *Proc. Cal. Acad. Sci.* (2), **5**, 418, pl. 32, 1895; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 803, 1896; **4**, pl. 125, fig. 339, 1900; Osborn and Nichols, *Bull. Amer. Mus. Nat. Hist.*, **35**, 156, 1916.

Type-locality.—Mazatlan, Mexico, in a tide pool.

Range.—Gulf of California and adjacent regions.

There are about 52 scales in the median longitudinal series in the type specimen of E. ERIARCHA.

XXVIII. PSEUDOTHYRINA Ribeiro, 1915.

PSEUDOTHYRINA Ribeiro, *Arch. Mus. Nac. Rio de Janeiro*, **17**, *Trematolepides*, 11, 1915.

Haplotype.—PSEUDOTHYRINA JHERINGI Ribeiro.

Range.—Southeastern Brazil.

99. Pseudothyrina jheringi Ribeiro, 1915.

PSEUDOTHYRINA JHERINGI Ribeiro, *Arch. Mus. Nac. Rio de Janeiro*, **17**, *Trematolepides*, 11, 1915; Ribeiro, *Rev. Mus. Pal.*, **10**, 763, 1918.

Type-locality.—Rio Grande do Sul.

Range.—Rio Grande do Sul, Brazil.

This is one of the large atherines characteristic of temperate South America. It is described as similar in form of body to THYRINA, but it differs from that genus in the less backward insertion of the first dorsal, the smaller size of the scales, etc.

XXIX. KRONIA Ribeiro, 1915.

KRONIA Ribeiro, *Arch. Mus. Nac. Rio de Janeiro*, **17**, *Trematolepides*, 9, 1915.

Haplotype.—KRONIA IGUAPENSIS Ribeiro.

Range.—Southeastern Brazil.

100. Kronia iguapensis Ribeiro, 1915.

KRONIA IGUAPENSIS Ribeiro, *Arch. Mus. Nac. Rio de Janeiro*, **17**, *Trematolepides*, 19, 1915.

Type-locality.—Iguape, S. Paulo, Brazil.

Range.—Southeastern Brazil (known only from the type locality).

This large South American atherine differs little from ODONTESTHES, insofar as the descriptions indicate. The scale margins are described as "sub-laciniadas" in KRONIA, as entire in ODONTESTHES; the teeth in bands in KRONIA, in two series in ODONTESTHES. It is not clear from the diagnosis of KRONIA whether that genus has the peculiar pike-like head and elongate abdominal region of ODONTESTHES.

XXX. ODONTESTHES Evermann and Kendall, 1906.

ODONTESTHES Evermann and Kendall, *Proc. U. S. Nat. Mus.*, **31**, 94, 1906; Hubbs, *Proc. Acad. Nat. Sci. Phila.*, **69**, 308, 1918.

Orthotype.—ODONTESTHES PERUGIÆ Evermann and Kendall.

Range.—Argentina and Uruguay.

101. Odontesthes perugiæ Evermann and Kendall, 1906.

(Plate III, Fig. 11)

? ATHERINICHTHYS VOMERINA Perugia, *Ann. Mus. Genova*, **30**, 621, 1891; Berg, *An. Mus. Nac. Buenos Aires*, **4**, 26, 1895 (not ATHERINA VOMERINA Cuvier and Valenciennes).

ODONTESTHES PERUGIÆ Evermann and Kendall, *Proc. U. S. Nat. Mus.*, **31**, 94, fig. 3, 1906.

Type-locality.—Argentina ("locality label lost; probably from fresh water").

Range.—Argentina; not definitely known.

102. Odontesthes platensis (Berg), 1895.

ATHERINICHTHYS PLATENSIS Berg, *An. Mus. Nac. Buenos Aires*, **4**, 27, 1895.

ODONTESTHES PLATENSIS Evermann and Kendall, *Proc. U. S. Nat. Mus.*, **31**, 95, 1906.

Type-locality.—Mar del Plata.

Range.—Argentina.

As Evermann and Kendall note, this species is probably congeneric with O. PERUGIÆ. The elongation of the jaws, and of the abdominal region of the body is, however, not described.

103. Odontesthes argentinensis (Cuvier and Valenciennes), 1835.

ATHERINA ARGENTINENSIS Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 472, 1835; Jenyns, *Zool. Beagle*, **4**, (*Fishes*), 77, 1842.

[BASILICHTHYS] ARGENTINENSIS Girard, *U. S. Nav. Astron. Exp.* **2**, 237, 1860.

ATHERINICHTHYS ARGENTINENSIS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 405, 1861 (and of most later authors).

CHIROSTOMA ARGENTINENSIS Eigenmann and Eigenmann, *Proc. U. S. Nat. Mus.*, **14**, 66, 1891.

[ODONTESTHES] ARGENTINENSIS Hubbs, *Proc. Acad. Nat. Sci. Phila.*, **69**, 308, 1918.

Type-locality.—Montevideo.

Range.—Uruguay and Argentina.

The posterior position of the spinous dorsal and the rather large scales (compared with other species of temperate South America) would seem to indicate close relationship with ODONTESTHES PERUGIÆ. The species is not described as having vomerine teeth, however.

XXXI. AUSTROMENIDIA Hubbs, 1918.

ATHERINICHTHYS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 402, 1861 (in part; not ATHERINICHTHYS Bleeker = CHIROSTOMA Swainson).

BASILICHTHYS of authors (not of Girard, *Proc. Acad. Nat. Sci. Phila.*, 198, 1854. Orthotype, ATHERINA MICROLEPIDOTA Jenyns. BASILICHTHYS Girard = GASTROPTERUS Cope = PISCIREGIA Abbott).

AUSTROMENIDIA Hubbs, *Proc. Acad. Nat. Sci. Phila.*, **69**, 307, 1918.
Orthotype.—BASILICHTHYS REGILLUS Abbott.
Range.—Temperate portion of South America, along the coast and in lakes and streams from Uruguay and Peru south to the Straits of Magellan; also about the Falkland and Juan Fernandez Islands

We refer to AUSTROMENIDIA most of the large fine-scaled atherines of temperate South America. The typical species are unlike those of other genera, but some of the species approach ODONTESTHES, KRONIA, and MENIDIA. The species are mostly poorly known, and have been greatly confused by ichthyologists. Several of the west coast species have been recorded on an obviously unsatisfactory basis from Argentina. We have made an effort to determine the proper synonymy, status and distribution of each form, as far as the facts are known.

104. Austromenidia bonariensis (Cuvier and Valenciennes), 1835.[St.]

ATHERINA BONARIENSIS Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 469, 1835.
[BASILICHTHYS] BONARIENSIS Girard, *U. S. Nav. Astron. Exp.*, 238, 1860.
ATHERINICHTHYS BONARIENSIS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 404, 1861 (and of authors in general).
CHIROSTOMA BONARIENSIS Eigenmann and Eigenmann, *Proc. U. S. Nat. Mus.*, **14**, 66, 1891.
BASILICHTHYS BONARIENSIS Evermann and Kendall, *Proc. U. S. Nat. Mus.*, **30**, 95, 1906.
MENIDIA BONARIENSIS Thompson, *Proc. U. S. Nat. Mus.*, **50**, 406, 1915.
ATHERINA BONASICOSI Bleeker, *Nalezingen op de Ichthyologie van Japan*, **41**, 1853 (apparently a slip in chirography for BONARIENSIS).
Type-locality.—Buenos Aires, Argentina.

? ATHERINA LESSONI Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 471, 1835 (based on an inadequate drawing).
Type-locality.—Santa Caterina, Brazil.

ATHERINA LICHTENSTEINII Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 476, 1835; Günther, *Catalogue Fishes Brit. Mus.*, **3**, 404, 1861.
Type-locality.—Montevideo, Uruguay.
Range.—Argentina, Uruguay, and possibly southeastern Brazil; chiefly in fresh water.

105. Austromenidia hatcheri (Eigenmann), 1909.[St.]

ATHERINICHTHYS MICROLEPIDOTUS Perugia, *Ann. Mus. Genova*, **30**, 32, 1891; Berg, *An. Mus. Nac. Buenos Aires*, **4**, 66, 1895.
BASILICHTHYS MICROLEPIDOTUS Evermann and Kendall, *Proc. U. S. Nat. Mus.*, **31**, 97, 1906; Thompson, *ibid.*, **50**, 464, 1916 (not ATHERINA MICROLEPIDOTA Jenyns).

MENIDIA HATCHERI Eigenmann, *Repts. Princeton Univ. Exp. Patagonia*, **3**, 281, pl. 37, fig. 4, 1909.
Type-locality.—Lake Pueyrredon, Patagonia.
Range.—Fresh waters of Argentina.

106. Austromenidia regia (Humboldt), 1835.[St.]

ATHERINA REGIA Humboldt, *Rec. Obs. Zool. Anat. Comp.*, **2**, 187, 1835; Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 474, 1835.

BASILICHTHYS REGIA Fowler, *Proc. Acad. Nat. Sci. Phila.*, **40**, 734, 1904.

MENIDIA REGIA Thompson, *Proc. U. S. Nat. Mus.*, **50**, 465, 1916.

Type-locality.—Callao, Peru.

ATHERINICHTHYS LATICLAVIA Günther, *Catalogue Fishes Brit. Mus.*, **3**, 402, 1861 (reference only).

ATHERINA LATICLAVIA Cope, *Proc. Amer. Phil. Soc.*, **17**, 44, 1878 (not ATHERINA LATICLAVIA Cuvier and Valenciennes).

BASILICHTHYS REGILLUS Abbott, *Proc. Acad. Nat. Sci. Phila.*, 339, 1899; Starks, *Proc. U. S. Nat. Mus.*, **30**, 783, 1906.

MENIDIA REGILLUS Thompson, *Proc. U. S. Nat. Mus.*, **50**, 466, 1916.

Type-locality.—Callao, Peru.

BASILICHTHYS OCTAVIUS Abbott, *Proc. Acad. Nat. Sci. Phila.*, 340, 1899; Evermann and Radcliffe, *Bull. U. S. Nat. Mus.*, **95**, 47-49, 1917.

Type-locality.—Callao, Peru.

BASILICHTHYS JORDANI Abbott, *Proc. Acad. Nat. Sci. Phila.*, 341, 1899.

Type-locality.—Callao, Peru.

CHIROSTOMA AFFINE Steindachner, *Denk. Akad. Wiss. Wien*, **72**, 40, 1902 (specimens from Callao, Peru, only; not of 1898).

BASILICHTHYS AFFINIS Evermann and Radcliffe, *Bull. U. S. Nat. Mus.*, **95**, 47, 1917 (specimens from Callao, Paracas Bay, and Ancon, Peru).

Range.—Coast of Peru.

107. Austromenidia laticlavia Cuvier and Valenciennes, 1835.[St.]

ATHERINA LATICLAVIA Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 473, 1835.

ATHERINICHTHYS LATICLAVIA Günther, *Catalogue Fishes Brit. Mus.*, **3**, 402, 1861 (in part?); Quijada, *Bol. Mus. Nac. Chile*, **5**, 56, pl. 9, 1913 (and of other authors).

CHIROSTOMA LATICLAVIA Steindachner, *Zool. Jahrb.*, Suppl. 4, 313, 1899.

MENIDIA LATICLAVIA Eigenmann, *Repts. Princeton Univ. Exp. Patagonia*, **3**, 281, 1903 (references in part).

Type-locality.—Valparaiso, Chile.

CHIROSTOMA AFFINE Steindachner, *Zool. Jahrb.*, Suppl. 4, 313, 1898; *Bol. Mus. Nac. Chile*, **5**, 184, 1913.

BASILICHTHYS AFFINIS Abbott, *Proc. Acad. Nat. Sci. Phila.*, 342, 1899.

Type-locality.—Iquique, Chile.

Range.—Coast of Chile, between 20° and 38° S. latitude.

We retain A. LATICLAVIA as a species distinct from A. REGIA, because the specimens at hand and the various published descriptions of the two forms indicate that the Peje-rei of Chile has the head proportionately smaller than the very similar fish from Peru (A. REGIA). It is not improbable that the two will be found to intergrade.

The records of LATICLAVIA from southern Chile (Smitt), Falkland Islands (Günther), and Argentina (Berg, etc.) probably all refer to other species of the genus.

108. Austromenidia gracilis (Steindachner), 1898.

CHIROSTOMA GRACILE Steindachner, *Zool. Jahrb.*, Suppl. 4, 314, 1898; *Bol. Mus. Nac. Chile*, **5**, 186, 1913 (not ATHERINICHTHYS GRACILIS Günther).

Type-locality.—Cumberland Bay, Island of Juan Fernandez.

Range.—Juan Fernandez Island, off Chile.

This species seems to be an insular representative of A. LATICLAVIA. The name GRACILIS may not be eligible, as CHIROSTOMA is the same as ATHERINICHTHYS.

109. Austromenidia brevianalis (Günther), 1880.

? ATHERINICHTHYS INCISA Kner, *Reise Novara, Fische*, 223, pl. 9, fig. 1, 1865 (not ATHERINA INCISA Jenyns).

ATHERINICHTHYS BREVIANALIS Günther, *Rept. Voy. Challenger*, **1**, pt. 6 *(Shore Fishes)*, 25, 1880.

Type-locality.—Valparaiso, Chile.

Range.—Coast of Chile.

A. BREVIANALIS has larger scales than any other Pacific species of the genus. It has the anal rays rather few in number, as in MAULEANA and ITATANA. A. INCISA of Kner (not Jenyns) is probably based on the same species, also having the scales comparatively large and the anal rays few.

110. Austromenidia mauleana (Steindachner), 1869.[St.]

CHIROSTOMA MAULEANUM Steindachner, *Ann. Naturhist. Hofmus. Wien*, **11**, 231, 1896; *Zool. Jahrb.*, Suppl. 4, 313, 1898.

MENIDIA MAULIANA Thompson, *Proc. U. S. Nat. Mus.*, **50**, 465, 1916.

Type-locality.—River Maule, Chile.

Range.—Rivers and possibly coast of Chile.

A. MAULEANA has the gill-rakers much fewer in number than in typical species of AUSTROMENIDIA.

111. Austromenidia itatana (Steindachner), 1896.

CHIROSTOMA ITATANUM Steindachner, *Ann. Naturhist. Hofmus. Wien*, **11**, 232, 1896.

Type-locality.—Itata River, Chile.

Range.—Chile, known only from the type-locality.

Judging from Steindachner's description, A. ITATANA is closely related to A. MAULEANA.

112. Austromenidia nigricans (Richardson) 1844.[St.]

ATHERINA NIGRICANS Richardson, *Voy. Erebus and Terror, Fishes*, **77**, pl. 42, figs. 13-18.

ATHERINICHTHYS NIGRICANS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 403, 1861; Smitt, *Bih. Sven. Vet.-Akad.*, **24**, pt. 4, No. 5, 29, pl. 4, fig. 29, 1898.

Type-locality.—Falkland Islands.

? ATHERINICHTHYS LATICLAVIA Günther, *Catalogue Fishes Brit. Mus.*, **3**, 403, 1861 (specimen from Falkland Island only).

ATHERINICHTHYS ALBURNUS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 403, 1861; Cunningham, *Trans. Linn. Soc. London*, **27**, 471, 1871.

MENIDIA ALBURNUS Thompson, *Proc. U. S. Nat. Mus.*, **50**, 423, 1916.

? ATHERINICHTHYS REGIA LATICLAVIA Smitt, *Bih. Sven. Vet.-Akad.*, **24**, pt. 4, No. 5, 32, pl. 4, fig. 30, 1898 (not ATHERINA LATICLAVIA Cuvier and Valenciennes).

? ATHERINICHTHYS REGIA MICROLEPIDOTA Smitt, *l. c.*, 32, pl. 4, fig. 31, 1898 (not ATHERINA MICROLEPIDOTA Jenyns).

MENIDIA PATAGONIENSIS Eigenmann, *Repts. Princeton Univ. Exp. Patagonia*, **3**, 280, 1909 (the footnote refers to this species, not to HATCHERI).

Type-locality.—"Probably at Sandy Point (Punta Arenas), Straits of Magellan."

Range.—Falkland Islands; Straits of Magellan, southern Chile.

This species has finer scales than any other of the genus. Its range is the most southern of any American atherine.

The two forms described by Smitt under the unavailable names LATICLAVIA and MICROLEPIDOTA may prove worthy of subspecific or even specific separation, in which case they will receive new names. These forms may have been based on intergrades between NIGRICANS and LATICLAVIA.

XXXII. CHIROSTOMA Swainson, 1839.

CHIROSTOMA Swainson, *Nat. Hist. Class. Anim.*, **2**, 243, 1839; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 792, 1896; Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 133, 1899 (1900); Meek, *Publ. Field Mus. (Zool.)*, **3**, 108. 1902; **5**, 166, 1904; Regan, *Biol. Centr.-Amer., Pisces*, 57, 1907 (in part); Eigenmann, *Repts. Princeton Univ. Exp. Patagonia*, **3**, 280, 1909.

Haplotype.—ATHERINA HUMBOLDTIANA Cuvier and Valenciennes.

ATHERINOIDES Bleeker, *Verh. Batav. Gen. Japan*, **25**, 40, 1853.

Orthotype.—ATHERINA VOMERINA Cuvier and Valenciennes (= HUMBOLDTIANA).

ATHERINICHTHYS Bleeker, *l. c.*, 40 (not ATHERINICHTHYS of most subsequent authors).

Orthotype.—ATHERINA HUMBOLDTIANA Cuvier and Valenciennes.

HETEROGNATHUS Girard, *Proc. Acad. Nat. Sci. Phila.*, 198, 1854.

Logotype.—ATHERINA HUMBOLDTIANA Cuvier and Valenciennes.

LETHOSTOLE Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 792, 1896; pt. 3, 2839, 1898; Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 133, 1899 (1900); Meek, *Publ. Field Mus. (Zool.)*, **3**, 108, 1902.

Orthotype.—CHIROSTOMA ESTOR Jordan.

ESLOPSARUM Jordan and Evermann, *Rept. U. S. Fish Comm.*, 330, 1895 (1896); Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 133, 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 3, 2840, 1898; Meek, *Publ. Field Mus. (Zool.)*, **3**, 108, 1902.

Orthotype.—CHIROSTOMA JORDANI Woolman.

Range.—Lerma River stream system of central Mexico, including the lakes and streams of the Rio Grande de Santiago, Rio Lerma Basin, the lakes and canals of the Valley of Mexico, and the Rio Mezquital Basin.

This genus is confined to the lakes and streams of the Lerma River system of Mexico, and of the valley of the City of Mexico. It includes all of the atherine fishes known from that district. Each one of the species described from variously remote localities under the name of

CHIROSTOMA or its synonym, ATHERINICHTHYS, proves on more critical examination to belong to some other genus of the family.

Even as thus restricted, CHIROSTOMA comprises a diverse, and at first consideration apparently unnatural, assemblage of species. We regard them all as congeneric only because of the existence of several species intermediate between each of the contrasting groups of species which has been distinguished. A graded series of species may be arranged in reference to each of the widely varying characters. The size varies from small to large; the vertebræ from 37 to 45 in number; the scales from 36 to 75 transverse series; the scale borders from strictly smooth to sharply crenate; the origin of the first dorsal from a position over that of the anal to a point as near the insertion of the ventral fin; the proportionate size of head, snout, and eye, from small to large; the elevation of the mandibular rami from slight to great; the projection of the mandible beyond the tip of the premaxillaries from little to much; the teeth from small to canine-like in size, and from a biserial to a band arrangement. The sequence of species in these several series, however, is not the same. Having determined these facts by an examination of all the known species of the genus, we are unable to make a satisfactory division of the group, diverse as it is.

CHIROSTOMA is very closely related to MENIDIA, from which it differs constantly in the projection of the lower jaw at its symphysis beyond the upper,[24] and the extension of the air bladder into the tail over about one-third to two-thirds of the anal base. Other distinctive features of CHIROSTOMA, as compared with MENIDIA, are usually but not always evident. These include the larger size; the development of vomerine teeth; the longer, more pointed pectoral fin; the small size of scales, their crenate margins, and the lack of circuli on their exposed fields. From THYRINA, equally near, CHIROSTOMA differs constantly in the more anterior position of the first dorsal fin, and the projection of the lower jaw; usually in the smaller size of the scales, etc. Some species of AUSTROMENIDIA resemble the finer-scaled species of CHIROSTOMA closely, even having the lower jaw as an individual variation slightly produced beyond the upper. This condition in AUSTROMENIDIA, as Abbott pointed out, is due rather to the weakness of the upper jaw, than to the increased strength of the lower jaw characteristic of CHIROSTOMA. The resemblance seems not due to close relationship.

We distinguish 18 species of CHIROSTOMA, two being named now for the first time. We find no evidence that the species are not well fixed, as intimated by Dr. Meek, and find but one instance of apparent

[24] Dr. Meek's figures of his species of CHIROSTOMA show the lower jaw decidedly too short, a fact which perhaps led Eigenmann to refer some of the species to MENIDIA, and to doubt the generic distinctiveness of the two groups.

hybridization. Their distribution is peculiar, several closely related species living together in the same lake. This rather anomalous condition is perhaps to be explained by the redistribution of the fish faunas of the various lakes by volcanic disturbances.

113. Chirostoma jordani Woolman, 1894.St.

(Plate VI, Fig. 21.)

CHIROSTOMA BRASILIENSIS Jordan, *Proc. U. S. Nat. Mus.*, **2**, 299, 1879 (not ATHERINA BRASILIENSIS Quoy and Gaimard).

CHIROSTOMA JORDANI Woolman, *Bull. U. S. Fish Comm.*, **14**, 62, pl. 2, 1894; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **21**, 540, 1898; Meek, *Publ. Field Mus. (Zool.)*, **3**, 112, 1902; **5**, 169, fig. 52, 1904; Regan, *Biol. Centr.-Amer., Pisces*, 59, 1909 (in part).

ESLOPSARUM JORDANI Jordan and Evermann, *Rept. U. S. Fish Comm.*, 330, 1895 (1896); *Bull. U. S. Nat. Mus.*, **47**, pt. 3, 2840, 1898; **4**, 3157, pl. 123, fig. 335, 1900; Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 133, 1899 (1900); Evermann and Goldsborough, *ibid.*, **21**, 152, 1901 (1902).

Type-locality.—Mexico City (now definitely restricted).

ATHERINICHTHYS BREVIS Steindachner, *Anz. Akad. Wiss. Wien*, **31**, 149, 1894.

CHIROSTOMA BREVE Steindachner, *Denk. Akad. Wiss. Wien*, **62**, 526, pl. 2, fig. 2, 1895.

Type-locality.—Lake Cuitzeo, Mexico.

Range.—Valley of Mexico, and the Lerma Basin; in streams, canals, and lakes.

CHIRSOTOMA BREVE (Steindachner) resembles C. JORDANI in the extreme obliquity of the gape. Contrary to Regan's view, we regard the two names as based on the same species.

A large series of JORDANI, including a specimen from Pátzcuaro, has been examined. The form of the body varies widely, in places resembling C. ARGE. The anal rays are occasionally as numerous as I, 20. The teeth are finer than in most species; those of the upper jaw appear to be arranged in a narrow band; none are especially enlarged.

114. Chirostoma mezquital Meek, 1904.St.

(Plate V, Fig. 20)

CHIROSTOMA MEZQUITAL Meek, *Publ. Field Mus. (Zool.)*, **5**, 170, fig. 53, 1904.

Type-locality.—Rio Mezquital, near Durango, Mexico.

CHIROSTOMA JORDANI Regan, *Biol. Centr.-Amer., Pisces*, 59, 1907 (in part).

Range.—Basin of the Rio Mezquital, Mexico.

Mr. Regan's reference of this species to C. JORDANI is erroneous, the differences indicated by Meek in his description and figure of MEZQUITAL being constant. In the nine type specimens of MEZQUITAL, the mouth is decidedly less oblique than in JORDANI; the body is less compressed; the head is less angular in either anterior or superior aspect; the origin of the spinous dorsal is farther forward (midway between base of caudal and a point forward of the tip of snout, a distance varying from a little less than half eye, to more than length of eye). In a large series of JORDANI from the Valley of Mexico and the Lerma Basin, the origin of the first dorsal is midway between the base of the

caudal and a point varying from more than the length of the eye behind the snout, to a little more than half length of eye before snout. C. MEZQUITAL is perhaps quite as closely related to C. ARGE, but is likewise distinct from it.

In C. MEZQUITAL the teeth are disposed rather definitely in two series in the jaws, those of the outer mandibular and inner premaxillary series slightly enlarged. The teeth erroneously said to be uniserial in the type description.

115. Chirostoma labarcæ Meek, 1902.[St.]

(Plate VI, Fig. 22)

CHIROSTOMA LABARGÆ Meek, *Publ. Field Mus. (Zool.)*, **3**, 113, pl. 27, 1902; **5**, 173, 1904.

Type-locality.—Rio Lerma at La Barca, Jalisco, Mexico.

CHIROSTOMA BREVE Regan, *Biol. Centr.-Amer., Pisces,* 59, 1907 (in part; not of Steindachner).

Range.—Vicinity of Lake Chapala, Mexico (known only from La Barca and La Palma).

This very distinct species is identical neither with BREVE (= JORDANI), as Mr. Regan suggested, nor with the species (REGANI) which he described under the name BREVE. It is perhaps most closely related to C. JORDANI, which is the only other species in which the first dorsal fin begins over the origin of the anal. It differs from JORDANI, as well as from all other large-scaled species of the genus, in the long and acutely pointed snout.

The dentition of this species has not been accurately described. The teeth are in two irregular series in both jaws; those of the outer series in the mandible are enlarged; those of the inner premaxillary series become canine-like toward the front of the jaws.

116. Chirostoma arge (Jordan and Snyder), 1900.[St.]

(Plate VI, Fig. 23)

ESLOPSARUM ARGE Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 133, fig. 12, 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 4, 3158, 1900.

CHIROSTOMA ARGE Meek, *Publ. Field Mus. (Zool.)*, **3**, 112, 1902; **5**, 171, fig. 54, 1904; **7**, 156, 1907; Regan, *Biol.-Centr.-Amer., Pisces,* 59, 1907.

Type-locality.—Rio Verde, near Aguas Calientes, Mexico.

Range.—Rio Verde and Rio Lerma, and their tributaries, Mexico (not known from the lakes).

Topotypes of C. ARGE from Aguas Calientes and Lagos (also in the Rio Verde Basin) are more slender than the holotype. Others from San Miguel de Allende, taken in a tributary to the Rio Lerma, are more robust in form; in these specimens the pectoral fins are usually but not always longer, and all of the fins much more deeply pigment, than in the topotypes. Five young specimens from Salamanca, included in the type lot of C. JORDANI Woolman, have a still longer pectoral, this

fin being about two-fifths, instead of one-third, as long as the interspace between occiput and spinous dorsal; the eye is larger and the head broader than in young of similar size in the other series mentioned above (the diameter of the eye and the width of the interorbital are each longer than the snout). Possibly more than one species is included in these several series.

The dentition of C. ARGE differs from that of JORDANI, MEZQUITAL, or LABARCÆ. The premaxillary teeth are in two series laterally, and about three series anteriorly, where those of the outer series, slightly enlarged throughout, are somewhat longer than those of the inner series.

117. **Chirostoma bartoni** Jordan and Evermann, 1896.[St.]

(Plate VI, Fig. 24)

CHIROSTOMA HUMBOLDTIANUM Jordan, *Proc. U. S. Nat. Mus.*, **2**, 299, 1879 (not ATHERINA HUMBOLDTIANA Cuvier and Valenciennes).

CHIROSTOMA BARTONI Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 793, 1896; Evermann and Goldsborough, *Bull. U. S. Fish Comm.*, **21**, 152, 1901 (1902); Meek, *Publ. Field Mus. (Zool.)*, **3**, 112, 1902; **5**, 172, 1904; Regan, *Biol. Centr.-Amer. Pisces*, 58, 1907 (in part).

ESLOPSARUM BARTONI Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 3, 2840, 1898.

Type-locality.—A tributary of the Rio Lerma, near Guanajuato, Mexico.

CHIROSTOMA ATTENUATUM Meek, *Publ. Field Mus. (Zool.)* **3**, 112, pl. 27, 1902; **5**, 172, fig. 55, 1904.

Type-locality.—Lago de Pátzcuaro, Michoacan, Mexico.

Range.—Tributaries of the Lerma River, Lake Lerma, and Pátzcuaro, Mexico.

Mr. Regan was certainly in error in referring the more finely scaled C. ZIRAHUEN to this species. He seems to have been correct, however, in assigning ATTENUATUM to BARTONI, as a reëxamination of Dr. Meek's material indicates. The specimens of BARTONI from Lake Lerma and the Lerma fish-hatchery have the spinous dorsal in the same position as in the types of ATTENUATUM from Lake Pátzcuaro; in both series the soft anal rays vary from 13 to 15.

The fine teeth of BARTONI are biserially arranged in the jaws. The teeth of the outer mandibular series are curved and slightly enlarged; those of the two premaxillary series are of subequal size, slightly enlarged in the inner series near front of jaws.

118. **Chirostoma zirahuen** Meek, 1902.[St.]

(Plate VII, Fig. 25)

CHIROSTOMA ZIRAHUEN Meek, *Publ. Field Mus. (Zool.)*, **3**, 114, pl. 28, 1902; **5**, 174, fig. 57, 1904.

Type-locality.—Lago de Zirahuen, Zirahuen, Michoacan, Mexico.

CHIROSTOMA BARTONI Regan, *Biol. Centr.-Amer., Pisces*, 58, pl. 10, fig. 2, 1907 (in part) (not of Jordan and Evermann).

Range.—Lake Zirahuen, Mexico.

The scales of this form, as indicated by Dr. Meek's description and figure, are finer than in C. BARTONI (= ATTENUATUM), to which species Mr. Regan wrongly referred ZIRAHUEN.

In C. ZIRAHUEN the teeth are biserial or nearly so. Those of the outer series of the mandible are enlarged, but still small. A similar relation holds true for the upper jaw laterally, but anteriorly the teeth of both premaxillary series are about as large as those of the outer mandibular row.

119. Chirostoma patzcuaro Meek, 1902.[St.]

(Plate VII, Fig. 26)

CHIROSTOMA PATZCUARO Meek, *Publ. Field Mus., Zool.*, **3**, 113, pl. 27, 1902; **5**, 174, fig. 56, 1904; Regan, *Biol. Centr.-Amer., Pisces*, 58, pl. 10, fig. 1, 1907.

Type-locality.—Lago de Pátzcuaro, Mexico.

Range.—Lake Pátzcuaro, Pátzcuaro, Mexico.

The type figure of this species, and that of C. ZIRAHUEN, are poorly drawn, showing the eye too large and the lower jaw too short.

The teeth of C. PATZCUARO are arranged in narrow bands. The outermost teeth of the lower jaw, and the innermost of the anterior teeth in the upper jaw, are enlarged, but not canine-like.

CHIROSTOMA PATZCUARO differs from C. ZIRAHUEN in the more compressed form, more numerous anal rays, the crenate scales, etc. From C. HUMBOLDTIANUM, with which it was taken in Lake Pátzcuaro, it differs in the smaller size attained, in the higher and more anteriorly inserted first dorsal, and in dentition. It resembles HUMBOLDTIANUM quite closely, however, like that species having the scale margins weakly crenate. Dr. Meek in 1902 placed the two species in different subgenera, and having overlooked their crenate scale margins, excluded both from the subgenus LETHOSTOLE.

120. Chirostoma humboldtianum (Cuvier and Valenciennes), 1835.[St.]

(Plate VIII, Fig. 27)

ATHERINA HUMBOLDTIANA Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 479, pl. 306, 1835.

ATHERINICHTHYS HUMBOLDTI Günther, *Catalogue Fishes Brit. Mus.*, **3**, 404, 1861 (altered spelling).

CHIROSTOMA HUMBOLDTIANUM Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 793, 1896; pt. 3, 2839, 1898; pt. 4, 123, fig. 334, 1900; Evermann, *Proc. Biol. Soc. Wash.*, **12**, 2, 1898; Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 134, 1899 (1900); Evermann and Goldsborough, *ibid.*, **21**, 152, 1901 (1902); Meek, *Publ. Field Mus. (Zool.)*, **3**, 114, 1902; **5**, 175, 1904; Regan, *Biol. Centr.-Amer., Pisces*, 60, 1908.

Type-locality.—Lake near City of Mexico.

ATHERINA VOMERINA Cuvier and Valenciennes, *Hist. Nat. Poiss.*, **10**, 481, 1835.

Type-locality.—Lake near City of Mexico.

Range.—Lakes in the Valley of Mexico and the Lerma Basin, Mexico.

As Jordan and Evermann noted in 1898, the scale margins in this species become laciniate with age, a character supposed to distinguish the group LETHOSTOLE. The differences between HUMBOLDTIANUM, type of CHIROSTOMA, and ESTOR, the type of LETHOSTOLE, are not wide, consisting of the size of the scales, the amount of projection of the mandible, and other details. We do not regard the two groups as subgenerically separable.

The teeth in C. HUMBOLDTIANUM are small and form a narrow band posteriorly in each jaw, but anteriorly are less reduced in size, and tend to assume a biserial arrangement. In one specimen at hand the anterior premaxillary teeth are arranged biserially on one side, triserially on the other. The teeth of the inner series are a little larger than those of the outer series in the lower jaw, but not notably larger in the upper jaw.

121. Chirostoma regani Jordan and Hubbs, new species, 1919.*St.*

CHIROSTOMA BREVE Regan, *Biol. Centr.-Amer., Pisces,* 59, pl. 10, fig. 3, 1907 (description and figure based upon specimens originally included in the same lot as that now comprising the types of C. REGANI; not ATHERINICHTHYS BREVIS Steindachner).

CHIROSTOMA REGANI Jordan and Hubbs, new species.

Type-locality.—Xochimilco, in the Valley of Mexico.

Range.—Lakes Xochimilco and Pátzcuaro, Mexico.

Holotype.—A mature female 94 mm. long to caudal base, collected in 1901 by Dr. S. E. Meek, at Xochimilco, in the Valley of Mexico; Cat. No. 3687, Field Museum of Natural History. Paratypes from the same locality, some obtained in 1901, others in 1903, the longest just as large as the type, are deposited in the fish collections of the Field Museum and Stanford University. Other specimens from Lake Pátzcuaro are at hand, showing the same variations as those exhibited by the type series.

CHIROSTOMA REGANI has been described and figured by Regan under the name of BREVE, which is really a synonym of JORDANI. He also referred the very different LABARCÆ to BREVE. C. REGANI is perhaps most closely related to HUMBOLDTIANUM, but differs from that species in its smaller size, larger and more completely crenate scales, shorter and blunter snout, smaller eye, etc. From PATZCUARO, a species of similar size, it is distinguished by the same proportional differences, and by the more posteriorly inserted first dorsal. It has finer scales, a smaller eye, etc., than GRANDOCULE. It differs from CHAPALÆ, to which it is also closely related, in the firmer flesh, less compressed body, convex lower margin of mandible, less oblique maxillary, fewer gill-rakers, and fewer anal rays.

Body gracefully slender, the contours gradually converging backward and forward from the middle and deepest point of the fish's length; greatest depth, 5.2 (4.7 to 5.4)[25] in length without caudal; depth of caudal peduncle, 2.6 (2.2 to 2.6) in its length behind end of anal base, 2.6 (2.5 to 2.8) in length of head to opercular margin (excluding membrane). Head, 4.2 (4.0 to 4.35). Orbit placed anteriorly, its hinder margin being equidistant from tip of snout and from margin of branchiostegal membrane; length of orbit, 4.2 (4.0 to 4.4) in head; length of moderately blunt snout, 3.4 (3.4 to 3.6); least interorbital width, 3.6 (3.4 to 3.8). Upper jaw strongly curved, but less oblique posteriorly than in CHAPALÆ or JORDANI; maxillary extending backward almost (or quite) to the vertical from the anterior margin of the orbit; length of upper jaw, 2.8 (2.6 to 3.0) in head; mandible strong, elevated within the mouth, its lower margin slightly convex to its blunt tip, which projects a little farther forward than the premaxillaries; lips rather thick posteriorly. Teeth fine, disposed in bands along jaws; teeth of outer mandibular series slightly enlarged; teeth a little enlarged in an inner and an outer series on the premaxillary, between which there is a band of fine teeth, narrowest anteriorly; outer premaxilliary teeth visible from above in some specimens; vomer with a few teeth (not evident in some specimens). Gill-rakers, 4 + 15 (in a paratype) as in HUMBOLDTIANUM, much fewer and stouter than in CHAPALÆ, the longest scarcely more than half as long as the orbit.

Air bladder extended backward nearly to above middle of anal base. Vertebræ 42 (in a paratype), fewer than in BARTONI. Now BARTONI, by reason of its large and entire marginal scales, has been placed in a subgenus or genus supposedly distinguished from CHIROSTOMA, to which REGANI is referable, by its *fewer* vertebræ. It is such facts as this that have led us to unite all of the CHIROSTOMA-like fishes into a single undivided group.

Scales moderate, reduced in size on the nape; in 45 (43 to 49) series from above branchial aperture to end of last vertebra; in 12 (11 to 14) series above anal origin; in 7 (6 to 8) series between origins of dorsals. Scale margins finely crenate.

Fin formula: dorsal, IV (or V)–I, 10 (9 to 11); anal, I, 18 (15 to 20); pectoral, 14 (12 to 14). First dorsal inserted a little before vertical from tips of ventrals (which do not quite reach to anus), equidistant from base of caudal and from middle of snout; first dorsal when depressed extending backward about three-fourths the distance from its origin to the second dorsal; its length thus measured contained 2.35

[25] Measurements in parentheses are those of ten paratypes from Xochimilco, 75 to 94 mm. long to caudal.

(2.2 to 2.5) times in head; second spine longest. Base of slightly falcate second dorsal shorter than its height, which is contained 1.5 (1.4 to 1.7) times in head. Anal fin somewhat falcate, a little higher than second dorsal; its base slightly shorter than (in paratypes as long as, or a little longer than) the head. Pectoral pointed, 1.3 (1.2 to 1.4) in head, overlying the anterior one-fourth (to two-fifths) of the length of the depressed ventral fin.

Some specimens, including the holotype, are very light in color, while others are deep brown; scales of the back in light specimens, and those of the sides also in dark ones, dark-margined. Lateral band distinct, about as wide as a scale on the tail. Snout and chin more or less deeply pigmented. Colors of the fins varying with that of the body. Peritoneum silvery, mottled with dusky and spotted with black, in light-colored individuals; uniform black in the darkest ones. (A similar wide range of coloration occurs in the series of HUMBOLDTIANUM from Xochimilco.)

122. Chirostoma chapalæ Jordan and Snyder, 1900.[St.]

(Plate VIII, Fig. 28)

CHIROSTOMA CHAPALÆ Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 135, fig. 13, 1899 (1900); Jordan and Evermann, *Bull U. S. Nat. Mus.*, **47**, pt. 4, 3159, 1900; Pellegrin, *Bull. Mus. Hist. Nat. Paris*, **7**, 205, 1901; Meek, *Publ. Field Mus. (Zool.)*, **3**, 115, 1902; **5**, 176, fig. 58, 1904; Regan, *Biol. Centr.-Amer., Pisces*, 61, 1907.

Type-locality.—Laguna de Chapala, near Ocotlan, Mexico.

Range.—Lake Chapala, Mexico.

The following variations are exhibited by a series of twelve specimens of C. CHAPALÆ from La Palma. Depth of body, 5.2 to 6.2 in length to caudal (60 to 78 mm.); length of head (including opercular membrane), 4.0 to 4.4; length of snout, 3.4 to 3.8 in head; orbit, 3.3 to 3.6; mandible, 2.5 to 2.7; scales in 48 to 52 transverse series, in 13 or 14 longitudinal series above anal origin, in 7 to 9 series between origins of dorsals; fin rays; dorsal, IV or V–I, 10 to 12; anal, I, 19 to 22.

123. Chirostoma consocium Jordan and Hubbs, new species, 1919.[St.]

CHIROSTOMA GRANDOCULE Meek, *Publ. Field Mus. (Zool.)*, **3**, 115, 1902 (in part); **5**, 176, 1904 (in part).

CHIROSTOMA GRANDOCULIS Regan, *Biol. Centr.-Amer., Pisces*, 61, 1907 (in part) (not ATHERINICHTHYS GRANDOCULIS Steindachner).

CHIROSTOMA CONSOCIUM Jordan and Hubbs, new species.

Type-locality.—Lake Chapala, at La Palma, Michoacan, Mexico.

Range.—Lake Chapala and its outlet, Rio Grande de Santiago.

Holotype.—A specimen 77 mm. long to caudal base, from Lake Chapala, at La Palma, Michoacan, Mexico; collected by Dr. S. E. Meek, May 30-31, 1901; Cat. No. 3672, Field Museum of Natural History; taken with numerous paratypes of smaller size. Other paratypes were

secured by Dr. Meek at Ocotlan, Jalisco, Mexico, in the Rio Grande de Santiago, June 2 and 3, 1901.

This species most closely resembles C. GRANDOCULE of Lake Pátzcuaro, and C. CHAPALÆ of Lake Chapala. From GRANDOCULE (topotypes examined) it differs in the smaller size attained; in the deeper and more compressed body; more translucent flesh, particularly that of the head; in the longer head, larger eye and sharper snout, and in the larger size of the scales. The proportional differences, which, though evident, are not wide in the adults, are accentuated in the young. From specimens of C. CHAPALÆ, with which the numerous types were taken, CONSOCIUM differs constantly in the smaller size of the scales, the deeper body, larger head, more pointed snout, and the longer and much less oblique jaws.

Three specimens in the large series of the two species taken together at La Palma, while agreeing with CONSOCIUM in the fineness of their scales, have the smaller *more oblique* mouth of CHAPALÆ, and are definitely intermediate between the two forms in the length of the head and depth of the body. It seems certain that these specimens do not exhibit the extremes of the continuous variation of either species. We interpret them as possibly hybrids between CHAPALÆ and CONSOCIUM. The distinctive characters of the two species are contrasted with those of the supposed hybrids in the following table:

	C. CHAPALÆ	Hybrids?	C. CONSOCIUM
Depth of body	5.2 to 6.2	5.0 to 5.4	4.7 to 5.3
Length of head	4.0 to 4.4	3.7 to 3.85	3.2 to 3.6
Length of mandible	2.5 to 2.7	2.6 to 2.7	2.3 to 2.5
Transverse scale rows	44 to 52	57 to 61	53 to 63
Longitudinal scale rows	12 to 14	16 to 18	17 to 19
Scale rows between origins of dorsal fins	6 to 9	10 to 12	10 to 13

Body rather strongly compressed and moderately slender; the dorsal and ventral contours evenly converging, like the edges of a spear-point, to the sharply pointed tips of the snout, which is lower than in CHAPALÆ, being on a horizontal passing through middle of eye and thence through middle of body; greatest depth of body, 5.3 (4.7 to 5.3)[26] in length without caudal; least depth of caudal peduncle, 2.0 (1.8 to 2.2) in its length behind end of anal base, a little longer (or a little shorter) than length of snout. Length of head (including opercular membrane), 3.3 (3.2 to 3.6) in length of body without caudal. Fore part of head

[26] The measurements and counts in parentheses are those of ten or more paratypes 60 to 74 mm. long, from La Palma.

rather elongate, and sharply pointed whether viewed from above or from the side; posterior margin of eye midway between tip of snout and lower end of pectoral base; length of eye, 3.6 (3.4 to 3.8); length of snout, 3.35 (3.2 to 3.6); least interorbital width, 5.4 (4.4 to 5.6). Premaxillaries sharply produced forward not quite so far as the symphysis of the mandibles; edge of premaxillaries curved less sharply than usual in CHIROSTOMA; upper jaw extended backward slightly beyond vertical from front of eye, its length 2.75 (2.4 to 2.8); mandible of moderate strength, its lower edge slightly concave near the symphysis; mandibular rami elevated within the mouth, the distance from its crest to the posterior end of the mandible contained about 1.6 times in its entire length (as in CHAPALÆ and GRANDOCULE); length of mandible, 2.4 (2.3 to 2.5) in head. Teeth small, arranged in two series, between which other teeth are inserted toward the front of the lower jaw; teeth of the inner premaxillary and outer mandibular series, somewhat enlarged; vomer apparently edentulous. Gill-rakers serrulate, 4 + 19 in the type, the longest as long as the pupil.

Air bladder extended backward into tail over about one-third of the anal base. Vertebræ, 43 (in a paratype).

Scales rather small, reduced in size near head, in 58 (53 to 63) series from edge of scapular arch above gill opening to end of hypural; in 18 (17 to 19) series above anal origin, in 11 (10 to 13) series between origins of dorsals. Scale margins broadly rounded and weakly crenate in adult, pointed and scarcely crenate in the young.

Fin rays: dorsal, IV (IV to VI)–I, 11 (11 or 12); anal, I, 20 (18 to 21); pectoral, 15 (14 to 16). Origin of spinous dorsal over tips of ventrals (varying somewhat), midway between base of caudal and end of second (or first) third of length of snout (rarely slightly nearer tip of snout than base of caudal); first dorsal when depressed extending backward more than two-thirds the distance to the second dorsal, its length thus measured contained 3.4 (3.5 to 2.9) times in the head; second (or first) spine longest. Second dorsal decidedly higher than long; its edge slightly falcate. Anal slightly higher than second dorsal; its base equal to length of head to preopercular ridge (or middle of opercle). Pectoral pointed, its lower margin straight; the fin overlying about half the length of the depressed ventral, which reaches nearly (or quite) to the anus; length of pectoral, 1.6 (1.3 to 1.6) in head.

This species is doubtless translucent in life; even in preserved specimens the fore part of the head is almost transparent (opaque in GRANDOCULE). The coloration is like that of CHAPALÆ, which was thus described: "a silvery band one scale wide, bright and distinct posteriorly, becoming indistinct anteriorly; upper edge of lateral band dusky; scales

on dorsal part of body edged with dark dots; jaws with dark dots; upper part of eye black; the dark, pigmented arachnoid shows through the skull." Fins all clear.

124. **Chirostoma grandocule** (Steindachner), 1894.[St.]

ATHERINICHTHYS GRANDOCULIS (Steindachner), *Anz. Akad. Wiss. Wien,* **31,** 149, 1894.
CHIROSTOMA GRANDOCULE Steindachner, *Denk. Akad. Wiss. Wien,* **62,** 525, pl. 2, fig. 1, 1895; Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 3, 2839, 1898; Meek, *Publ. Field Mus. (Zool.),* **3,** 115, 1902 (in part); **5,** 176, 1904 (in part).
CHIROSTOMA GRANDOCULIS Regan, *Biol. Centr.-Amer., Pisces,* 61, 1907 (in part).
Type-locality.—Lake Pátzcuaro.
Range.—Lake Pátzcuaro, Mexico.

As far as known, this species is confined to Lake Pátzcuaro, the specimens recorded by Meek from Lake Chapala representing a distinct species, here described as C. CONSOCIUM. For use in comparing the two species, we add here the following measurements and counts of six topotypes of C. GRANDOCULE, 79 to 82 mm. long to caudal.

Depth of body, 5.2 to 5.5, length of head (including opercular membrane), 3.5 to 3.75; length of eye, 3.8 to 4.1; snout, 3.4 to 3.5; mandible, 2.4 to 2.65; scales in the median longitudinal series, 60 to 72; in a transverse series above anal origin, 16 to 19; in a series between origins of dorsals, 9 to 12; dorsal rays, V–I, 11 or 12; anal, I, 18 to 21.

125. **Chirostoma promelas** Jordan and Snyder, 1900.[St.]

(Plate VIII, Figs. 29, 30)

CHIROSTOMA PROMELAS Jordan and Snyder, *Bull. U. S. Fish Comm.,* **19,** 136, fig. 14, 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.,* **47,** pt. 4, 3160, 1900; Pellegrin, *Bull. Mus. Hist. Nat. Paris,* **7,** 205, 1901; Evermann and Goldsborough, *Bull. U. S. Fish Comm.,* **21,** 152, 1901 (1902); Meek, *Publ. Field Mus. (Zool.),* **3,** 115, 1902; **5,** 177, 1904; Regan, *Biol. Centr.-Amer., Pisces,* 62, 1907.
Type-locality.—"Market of Guadalajara, Jalisco, Mexico; said to have come from Laguna de Chapala."
Range.—Lake Chapala, Mexico.

In C. PROMELAS, as in the other species of the genus, the lower jaw is very strong; in this species alone, however, the premaxillaries are so sharply and extensively produced forward, obviously as a secondary variation, that they project beyond the mandibular symphysis.

126. **Chirostoma lucius** Boulenger, 1900.[St.]

(Plate VIII, Fig. 31)

CHIROSTOMA LUCIUS Boulenger, *Ann. Mag. Nat. Hist.* (7), **5,** 54, 1900 (in part, *fide* Regan); Jordan, *Bull. U. S. Fish Comm.,* **19,** 137, 1899 (1900) (footnote); Meek, *Publ. Field Mus. (Zool.),* **3,** 115, 1902; **5,** 178, fig. 60, 1904; Regan, *Biol. Centr.- Amer., Pisces,* 62, 1907.
Type-locality.—Lake Chapala.

CHIROSTOMA CRYSTALLINUM Jordan and Synder, *Bull. U. S. Fish Comm.*, **19**, 139, figs. 16, 17, 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 4, 3162, 1900.

Type-locality.—"Laguna de Chapala, near Ocotlan, Jalisco, Mexico."

Range.—Lake Chapala, Mexico.

127. **Chirostoma diazi** Jordan and Snyder, 1900.[St.]

(Plate VIII, Fig. 32)

CHIROSTOMA DIAZI Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 137, fig. 15, 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 4, 3161, 1900; Regan, *Biol. Centr.-Amer., Pisces*, 62, 1907.

Type-locality.—"Market of Guadalajara, Jalisco, Mexico, . . . said to have come from Lake Chapala."

CHIROSTOMA SPHYRÆNA Jordan, *Bull. U. S. Fish. Comm.*, **19**, 137, 1899 (1900) (footnote); Meek, *Publ. Field Mus.* (*Zool.*) **3**, 116, 1902; **5**, 177, fig. 59, 1904 (not C. SPHYRÆNA Boulenger, *fide* Regan, *l. c*).

Range.—Lake Chapala, Mexico.

128. **Chirostoma sphyræna** Boulenger, 1900.[St.]

(Plate IX, Figs. 35, 36)

CHIROSTOMA SPHYRÆNA Boulenger, *Ann. Mag. Nat. Hist.* (7), **5**, 55, 1900; Regan, *Biol. Centr.-Amer., Pisces*, 63, pl. 9, fig. 2, 1908.

Type-locality.—Lake Chapala, Mexico.

CHIROSTOMA LERMÆ Jordan and Snyder, *Bull. U. S. Fish. Comm.*, **19**, 142, fig. 19, 1899 (1900); Jordan and Evermannn, *Bull. U. S. Nat. Mus.*, **47**, pt. 4, 3163, 1900; Meek, *Publ. Field Mus. (Zool.)*, **3**, 116, 1902; **5**, 179, fig. 61, 1904.

Type-locality.—"Market of Guadalajara; said to have come from Laguna de Chapala, Jalisco, Mexico."

Range.—Lake Chapala, Mexico.

The teeth are stronger in this species than in any other American atherinid. They are set in sockets, which are, however, shallower than those of SPHYRÆNA, which genus this species greatly resembles. The teeth are usually in two series, but a third series in some specimens is interpolated between the main two.

A young specimen from La Palma, 74 mm. long to caudal, shows all the distinctive features of the species.

129. **Chirostoma ocotlane** Jordan and Snyder, 1900.[St.]

(Plate IX, Figs. 33, 34)

CHIROSTOMA LUCIUS Boulenger, *Ann. Mag. Nat. Hist.* (7), **5**, 54, 1900 (in part, *fide* Regan).

CHIROSTOMA OCOTLANE Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 140, fig. 18, 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 4, 3163, 1900; Pellegrin, *Bull. Mus. Hist. Nat. Paris*, **7**, 205, 1901; Meek, *Publ. Field Mus.* (*Zool.*), **3**, 116, 1902; **5**, 180, fig. 62, 1904; Regan, *Bio. Centr.-Amer., Pisces*, 62, pl. 9, fig. 1, 1907.

Type-locality.—"Lago de Chapala, near Ocotlan, Jalisco, Mexico."

Range.—Lake Chapala, Mexico.

130 Chirostoma estor Jordan, 1879.St.

CHIROSTOMA ESTOR, Jordan, *Proc. U. S. Nat. Mus.*, **2**, 298, 1879; Steindachner, *Denk. Akad. Wiss. Wien*, **62**, 523, 1895; Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 141 (footnote), 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 3, 2839, 1898; pt. 4, 3165, 1900; Meek, *Publ. Field. Mus. (Zool.)*, **3**, 116, 1902; **5**, 180, 1904; Regan, *Biol. Centr.-Amer., Pisces*, 60, 1907.

LETHOSTOLE ESTOR Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 792, 1896.

Type-locality.—"Lake Chapala." (Perhaps by error. The type was sent to the U. S. National Museum by Dr. Alfredo Dugés of Guanajuato as "Pescado Blanco de Chapala," but subsequent collectors have not found it in Lake Chapala, while it abounds in Lakes Pátzcuaro, Zirahuen, and Xochimilco.)

ATHERINICHTHYS ALBUS Steindachner, *Anz. Akad. Wiss. Wien*, **31**, 148, 1894.

CHIROSTOMA ALBUM Jordan and Snyder, *Bull. U. S. Fish Comm.*, **19**, 141 (footnote), 1899 (1900); Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **4**, 3165, 1900.

Type-locality.—Lake Pátzcuaro, Mexico.

Range.—Lakes in the Lerma Basin and the Valley of Mexico (known from Lakes Pátzcuaro, Zirahuen, and Xochimilco).

This species is very similar to its congener, C. HUMBOLDTIANUM, but may be at once distinguished by the much smaller size of its scales.

As Dr. Meek has noted, the series from Lakes Pátzcuaro, Zirahuen, and Xochimilco are not wholly similar. Those from Xochimilco (like some examples of C. REGANI and C. HUMBOLDTIANUM from the same lake), are unusually light in color; they also have the head longer and narrower than in the others. The head is usually contained about 3.3 times in the length without caudal in specimens from Xochimilco; 3.5 times in those from Pátzcuaro; 3.7 times in those from Zirahuen. But in one from Zirahuen the proportion is 3.4, as in some from Pátzcuaro and Xochimilco. This difference is apparently to be regarded as racial rather than specific.

Teeth usually arranged in two or three series anteriorly, occasionally forming a narrow band; enlarged in the outer mandibular and inner premaxillary series.

XXXIII. LEURESTHES Jordan and Gilbert, 1880.

LEURESTHES Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **3**, 29, 1880; *Bull. U. S. Nat. Mus.*, **16**, 405, 1883; Jordan and Evermann, *ibid.*, **47**, pt. 1, 801, 1896.

Orthotype.—ATHERINOPSIS TENUIS Ayres.

Range.—Coasts of California and Lower California.

131. Leuresthes tenuis (Ayres), 1860.St.

(Plate XI, Fig. 39, from Photograph by Thompson)

ATHERINOPSIS TENUIS Ayres, *Proc. Cal. Acad. Nat. Sci.*, 76, 1860.

LEURESTHES TENUIS Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **3**, 29, 1880; *Bull U. S. Nat. Mus.*, **16**, 405, 1883; Jordan and Evermann, *ibid.*, **47**, pt. 1, 802; Hubbs, *Univ. Cal. Publ., Zool.*, **16**, 160, 1916; Osburn and Nichols, *Bull.*

Amer. Mus. Nat. Hist., **35**, 155, 1916; Jordan, *Copeia*, No. 56, 46, 1918; Barnhart, *Cal. Fish and Game*, **4**, 181, 1918; Thompson, *Bull. Cal. Fish and Game Comm.*, No. 3, 1-29, figs. 1-9 (babits), 1919; Higgins, *ibid.*, No. 5, 156, 1919; Thompson, *ibid.* 201, 203.

Type-locality.—San Francisco Bay.

LEURESTHES CRAMERI Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 802.

Type-locality.—Ballenas Bay, Cape Abreojos, Lower California.

Osburn and Nichols (1916) and Jordan (1918) seem to have demonstrated the identity of LEURESTHES CRAMERI with L. TENUIS, the form called CRAMERI living in the open sea, the original TENUIS in San Francisco Bay. The alleged difference in size of the scales does not hold.

The remarkable spawning habits of this species, locally known as the "Grunion," although popularly well known, were first mentioned in scientific literature by the junior author in 1916. Subsequently Mr. Percy S. Barnhart observed and reported in some detail on the phenomena, but it has remained for Mr. Will F. Thompson to determine the nature of the marvelous adaptations and adjustments involved. It appears that in six months of the year, chiefly March, April, May, and June, just after the crest of the latter high tides of the full-moon series, the grunion leaves the surf in large numbers, being washed high on the beach by the largest breakers. The eggs are then fertilized and laid well down in the sand, where they are covered still deeper by the deposition of sand which takes place on this level of the beach only during the complex of tide conditions noted above.

"The story concluded by the escape of the larvæ into the surf comprises one of the most marvelous of the many strange chapters in the life histories of fish. It is eloquent of exquisite adaptation to a seemingly minor physical phenomenon—the erosion of the beach by one part of a wave, and its upbuilding by another. Those waves are made use of which carry the fish high on the beach; those parts of the tide are utilized which allow the pods of eggs to be laid without risk that further rise of the tide will carry the eroded area over them; the runs occur during those nights in a series which are the last available, because of their height, thus eliminating in so far as possible the danger that unusually rough weather will sweep away the eggs; and the eggs are laid during those series of the tides which will allow the escape of the larvæ two weeks later. The larvæ themselves do not hatch until the sand over them is swept away, even though a month pass by; but when the time comes and the waves of the high tide wash over them, eroding the surrounding sand, they are ready to escape. The eggs are laid in what is nearly dry land, or moist soil, a fact which has no parallel in our knowledge of marine fishes. They are subject to attack by terrestrial enemies, but escape the far more numerous marine enemies. Indeed, so advantageous to the species are these adaptations that the

female lays thousands of eggs, where millions are laid by other forms"—Thompson (*l. c.*).

The eggs of LEURESTHES lack the long filament developed in MENIDIA and other genera, and considered as characteristic of the family. This is probably a generic character, confirming the distinctness of LEURESTHES from MENIDIA.

XXXIV. LABIDESTHES Cope, 1870.

LABIDESTHES Cope, *Proc. Amer. Phil. Soc.*, 455, 1870; Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 405, 1883; Jordan and Evermann, *ibid.*, **47**, pt. 1, 805, 1896.

Orthotype.—CHIROSTOMA SICCULUM Cope.

Range.—Fresh waters of eastern United States.

132. Labidesthes sicculus (Cope), 1865.[St.]

CHIROSTOMA SICCULUM Cope, *Proc. Acad. Nat. Sci. Phila.*, 81, 1865.

LABIDESTHES SICCULUS Cope, *Proc. Amer. Phil. Soc.*, 455, 1870; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 805, 1896, and of authors in general.

Type-locality.—Grosse Isle, Detroit River.

Range.—Streams, lakes and ponds from the Great Lakes Region of North America southward to Texas and Florida. A most graceful little fish.

XXXV. XENATHERINA Regan, 1908.

XENATHERINA Regan, *Biol. Centr.-Amer., Pisces*, 64, 1907; Jordan, *Proc. U. S. Nat. Mus.*, 309, 1919.

Orthotype.—MENIDIA LISA Meek.

Range.—East coast streams of southern Mexico.

This genus differs remarkably from all others in the family in squamation, the anterior part of the body being largely devoid of scales. In this respect it is approached only by the unrelated and even more aberrant genus Iso, of the western Pacific. The details of squamation are described by us in a recent publication (Jordan, 1919). XENATHERINA was probably derived from a type like THYRINA, which genus it resembles in several respects, such as the shortened belly, elongated anal fin, the extension of the air bladder a short distance into the urosome, and the slenderness of the mandibular rami. In addition to its peculiar squamation, XENATHERINA differs from the typical ATHERINOPSINÆ in the narrowly dilated premaxillaries, less curved and less restricted gape, and more slender mandibular rami.

133. Xenatherina lisa (Meek), 1904.[St.]

(Plate X, Fig. 37)

MENIDIA LISA Meek, *Publ. Field Mus. (Zool.)*, **5**, 182, fig. 63, 1904 (figure poor).

XENATHERINA LISA Regan, *Biol. Centr.-Amer., Pisces*, 64, 1907; Jordan, *Proc. U. S. Nat. Mus.*, 309, fig. 1, 1919.

Type-locality.—Refugio, Vera Cruz, Mexico, in the Rio Tonto, a tributary of the Rio Papaloapam.

Range.—Basin of the Rio Papaloapam, eastern Mexico (known only from the type locality).

The specimens from El Hule, mentioned in the original description of LISA, belong to a very different species, ARCHOMENIDIA SALLEI.

XXXVI. COLPICHTHYS Hubbs, 1918.

COLPICHTHYS Hubbs, *Proc. Acad. Nat. Sci. Phila.* 67, 1917 (1918).

Orthotype.—ATHERINOPS REGIS Jenkins and Evermann.

Range.—Gulf of California.

This group may be regarded as a subgenus of ATHERINOPS. For the present, however, we grant it separate standing.

134. Colpichthys regis (Jenkins and Evermann), 1888.

ATHERINOPS REGIS Jenkins and Evermann, *Proc. U. S. Nat. Mus.*, **11**, 138, 1888; *ibid.*, **14**, 137, 1891; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 807, 1896; Hubbs, *Bull. Amer. Mus. Nat. Hist.*, 419, 1918.

Type-locality.—Guaymas, Sonora.

Range.—Gulf of California; thus far recorded only from Guaymas.

XXXVII. ATHERINOPS Steindachner, 1875.

ATHERINOPS Steindachner, *Ichth. Beit.*, **3**, 61, 1875; *Sitzb. Akad. Wiss. Wien*, **72**, 89, 1875; Jordan and Evermann, *Bull. U. S. Nat. Mus.*, **47**, pt. 1, 807, 1896; Hubbs, *Bull. Amer. Mus. Nat. Hist.*, **38**, 409-440, 1918.

Orthotype.—ATHERINOPSIS AFFINIS Ayres.

Range.—Outer coast and adjacent islands of Lower California, California, and Oregon.

This genus in external characters bears a very strong resemblance to ATHERINOPSIS. The teeth, however, being Y-shaped or forked, are remarkably different.

135a. Atherinops affinis affinis (Ayres), 1860.[St.]

(Plate X, Fig. 38; Plate XII, Fig. 41)

ATHERINOPSIS AFFINIS Ayres, *Proc. Cal. Acad. Nat. Sci.*, 63, 1860.

ATHERINOPS AFFINIS AFFINIS Hubbs, *Bull. Amer. Nat. Hist.*, **38**, 420, 1918 (full synonymy).

Type-locality.—San Francisco, California.

ATHERINOPS OREGONIA Jordan and Snyder, *Proc. U. S. Nat. Mus.*, **45**, 575, pl. 46, 1913.

Type-locality.—Yachats River, Oregon.

Range.—Coast of Oregon and of California south to Monterey; including mouths of streams. South of Monterey A. A. AFFINIS intergrades with A. A. LITTORALIS.

It seems probable that examples of this species were among Girard's original types of ATHERINOPSIS CALIFORNIENSIS.

135b. Atherinops affinis littoralis Hubbs, 1918.[St.]

ATHERINOPS AFFINIS Auctorum, in part.

ATHERINOPS AFFINIS LITTORALIS Hubbs, *Bull. Amer. Mus. Nat. Hist.*, **38**, 426, 1918.

Type-locality.—North Island, San Diego Bay, California.

Range.—Coast of southern California, intergrading northward with A. A. AFFINIS, and southward with A. A. MAGDALENÆ.

This subspecies occurs in the mouth of San Diego Bay, and in the ocean at Coronado Beach.

135c. Atherinops affinis magdalenæ (Fowler), 1904.St.

ATHERINOPS MAGDALENÆ Fowler, *Proc. Acad. Nat. Sci. Phila.*, 740, pl. 42, 1903 (1904), lower figure.

ATHERINOPS AFFINIS MAGDALENÆ Hubbs, *Bull. Amer. Mus. Nat. Hist.*, **38**, 429, 1918.

Type-locality.—Magdalena Bay.

Range.—Southwestern coast of Lower California.

136a. Atherinops insularum insularum Gilbert, 1891.St.

ATHERINOPS INSULARUM Gilbert, *Proc. U. S. Nat. Mus.*, **14**, 549, 1891 (in part).

ATHERINOPS INSULARUM INSULARUM Hubbs, *Bull. Amer. Mus. Nat. Hist.*, **38**, 432, 1918 (complete synonymy).

Type-locality.—San Clemente Island (now definitely restricted).

Range.—Shores of the Santa Barbara Islands, off southern California.

136b. Atherinops insularum cedroscensis Hubbs, 1918.St.

ATHERINOPS INSULARUM CEDROSCENSIS Hubbs, *Bull. Amer. Mus. Nat. Hist.*, **38**, 434, 1918.

Type-locality.—Southeast side of Cedros Island.

Range.—Shores of Cedros and San Benito Islands, off the coast of central Lower California.

136c. Atherinops insularum guadalupæ Hubbs, 1918.St.

ATHERINOPS INSULARUM GUADALUPÆ Hubbs, *Bull. Amer. Mus. Nat. Hist*, **38**, 435,

Type-locality.—Guadalupe Island.

Range.—Guadalupe Island, off Lower California.

XXXVIII. ATHERINOPSIS Girard, 1854.

ATHERINOPSIS Girard, *Proc. Acad. Nat. Sci. Phila.*, **7**, 134, 198, 1854; Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 409, 1883; Jordan and Evermann, *ibid.*, **47**, pt. 1, 806, 1896.

Haplotype.—ATHERINOPSIS CALIFORNIENSIS Girard.

Range.—Western coast of temperate North America.

137. Atherinopsis sonoræ Osburn and Nichols, 1916.

ATHERINOPSIS SONORÆ Osburn and Nichols, *Bull. Amer. Mus. Nat. Hist.*, **35**, 156, fig. 8, 1916.

Type-locality.—Southeast side of Cedros Island, Lower California.

Range.—Cedros Island, Lower California.

138. Atherinopsis californiensis Girard, 1854.St.

(Plate XII, Fig. 42)

ATHERINOPSIS CALIFORNIENSIS Girard *Proc. Acad. Nat. Sci. Phila.*, **7**, 134, 1854; *U. S. Pac. R. R. Surv.*, **10**, pt. 4, 103, pl. 22c, 1858; *Boston Journ. Nat. Hist.*, **6**, 537, pl. 24, figs. 1-4, 1858; Jordan and Gilbert, *Bull. U. S. Nat. Mus.*, **16**, 409, 1883; Jordan and Evermann, *ibid.*, **47**, pt. 1, 806, 1896; **4**, pl. 125, fig. 341, 1900; Fowler, *Proc. Acad. Nat. Sci. Phila*, **40**, 739, 1904; Halkett, *Check List Fishes Canada*, 75, 1913; Osburn and Nichols, *Bull. Amer. Mus. Nat. Hist.*, **35**, 156, 1916; Hubbs. *ibid.*, **38**, 410, 1918.

ATHERINICHTHYS CALIFORNIENSIS Günther, *Catalogue Fishes Brit. Mus.*, **3**, 406, 1861.

CHIROSTOMA CALIFORNIENSE Jordan and Gilbert, *Proc. U. S. Nat. Mus.*, **3**, 29, 1880.

ATHERINA STORERI Ayres, in Girard, *Proc. Acad. Nat. Sci. Phila.*, 136, 1856 (*nom. nud.*).

Type-locality.—San Francisco.

Range.—Coasts and adjacent islands of western North America, from San Francisco south to Ballenas Bay, Lower California, and (according to Halkett) north to British Columbia.

The original description of this species is very brief and perhaps included specimens of ATHERINOPS AFFINIS.

XXXIX. BASILICHTHYS Girard, 1854.

BASILICHTHYS Girard, *Proc. Acad. Nat. Sci. Phila.*, **7**, 198, 1854; Thompson, *Proc. U. S. Nat. Mus.*, **50**, 464, 1916 (not BASILICHTHYS of authors in general, which is the group here termed AUSTROMENIDIA).

Orthotype.—ATHERINA MICROLEPIDOTA Jenyns.

PROTISTIUS Cope, *Proc. Acad. Nat. Sci. Phila.*, 60, 1874; Fowler, *ibid.*, **40**, 737, 1904.

Haplotype.—PROTISTIUS SEMOTILUS Cope.

GASTROPTERUS Cope, *Proc. Amer. Phil. Soc.*, **17**, 700, 1878 (name earlier used as GASTROPTERON, GASTEROPTERON, and GASTEROPTERA).

GASTEROPTERUS Fowler, *Proc. Acad. Nat. Sci. Phila.*, **40**, 738, 1904.

Haplotype.—GASTROPTERUS ARCHÆUS Cope.

PISCIREGIA Abbott, *Proc. Acad. Nat. Sci. Phila.*, 342, 1899; Jordan, *The Genera of Fishes* (Stanford University), 151, 1917.

Haplotype.—PISCIREGIA BEARDSLEEI Abbott.

Range.—Peru and Chile, in fresh and perhaps in salt water.

The South American atherinids with non-protractile premaxillaries are sufficiently differentiated from ATHERINOPSIS of North America to warrant their generic separation. The characters of the genera in question are outlined in the key.

139. Basilichthys microlepidotus (Jenyns), 1842.[St.]

ATHERINA MICROLEPIDOTA Jenyns, *Zool. Beagle*, **4**, (*Fish*), 78, pl. 16, fig. 1, 1842; Guichenot, in Gay, *Hist. Chile, Zool.*, **2**, 253, 1848; Kner, *Reise Novara, Fische*, 222, 1865.

BASILICHTHYS MICROLEPIDOTUS Girard, *Proc. Acad. Nat. Sci. Phila.*, **7**, 198, 1854; *U. S. Nav. Astron. Exp.*, 238, 1855.

ATHERINOPSIS MICROLEPIDOTUS Thompson, *Proc. U. S. Nat. Mus.*, **50**, 463, 1916.

Type-locality.—Valparaiso, Chile.

Range.—Streams and probably shores of Chile.

A reëxamination of Girard's figure and description of BASILICHTHYS MICROLEPIDOTUS indicates conclusively that he was dealing with a species of the present genus, rather than with a species of AUSTROMENIDIA, as formerly presumed by both Thompson and Hubbs. Although the premaxillaries are definitely stated to be protractile in Girard's description, his figure indicates the reverse. Among the diagnostic features of the present species the heavy projecting upper jaw, narrow suborbital, small first dorsal but high second dorsal and anal fins, the narrow, dull,

lateral band, the fine, basally radiate scales, etc., are well indicated by Girard. These considerations remove any doubt regarding the pertinence of the name BASILICHTHYS to the present genus.

140. Basilichthys archæus (Cope), 1878.[St.]

GASTROPTERUS ARCHÆUS Cope, *Proc. Amer. Phil. Soc.*, **17**, 700, 1878; Eigenmann, *Repts. Princeton Univ. Exp. Patagonia*, **3**, 464, 1910.

GASTEROPTERUS ARCHÆUS Fowler, *Proc. Acad. Nat. Sci. Phila.*, **40**, 138, pl. 43, 1904, upper figure.

Type-locality.—Arequipa, on the Pacific slope of Peru; elevation, 7500 feet.

PISCIREGIA BEARDSLEEI Abbott, *Proc. Acad. Nat. Sci. Phila*, 342, 1899.

GASTROPTERUS BEARDSLEEI Eigenmann, *Repts. Princeton Univ. Exp. Patagonia*, 3, 464, 1910.

Type-locality.—Callao, Peru.

ATHERINOPSIS REGIUS Steindachner, *Denk. Akad. Wiss. Wien*, **72**, 39, 1902; Evermann and Kendall, *Bull. U. S. Nat. Mus.*, **95**, 45, 1917 (not ATHERINA REGIA Humboldt = AUSTROMENIDIA REGIA).

Range.—Andean streams and possibly coasts of Peru.

We provisionally recognize this species as distinct from B. MICROLEPIDOTUS, the scales being apparently not quite so fine. The two require further comparison, however. The species may also be the same as the next. It is possible that the type of PISCIREGIA BEARDSLEEI came from a river.

141. Basilichthys semotilus (Cope), 1874.[St.]

PROTISTIUS SEMOTILUS Cope, *Proc. Acad. Nat. Sci. Phila.*, 66, 1875; Fowler, *ibid.*, **40**, 737, pl. 44, 1904.

Type-locality.—Some portion of the Peruvian Andes; elevation said to be 12,000 feet.

Range.—Pacific slope streams of the Peruvian Andes.

The specimen of PROTISTIUS SEMOTILUS before us comes from the Andes at an elevation of 7700-9000 feet. It was collected by Dr. Eigenmann in the Rimac River at Matucana, Peru. Head, 4.0; depth, 4.7; dorsal rays, I–I, 12; anal, I, 13; about 82 scales in the median longitudinal series; snout, 3.0; eye, 5.0; gill-rakers, 2 + 12; length to caudal, 100 mm.

Dr. Eigenmann, in a letter just received, notes the unexpected fact that the presence of but one dorsal spine, supposed to distinguish the genus PROTISTIUS from BASILICHTHYS, which has four or five, is wholly untrustworthy.

Of BASILICHTHYS (PROTISTIUS) SEMOTILUS, Dr. Eigenmann has specimens from Arequipa and Rio Rimac. "Of these, two have no dorsal spines whatever, nine have one, nine have two, one hundred have three, eighty-one have four, and six have five. Where is the line between PROTISTIUS and BASILICHTHYS? Of course, Cope's type of PROTISTIUS SEMOTILUS did not come from 12,000 feet elevation." (Eigenmann, *in lit.*, November, 1919.)

PLATE I.

Figure 1. Atherion elymus Jordan & Starks; type, Misaki, Japan.
Figure 2. Hepsetia morrisi (Jordan & Starks); type, Yakushima, Japan.
Figure 3. Hepsetia insularum (Jordan & Snyder); type, Honolulu.
Figure 4. Hepsetia stipes (Müller & Troschel); Bahama.

PLATE II.

Figure 5. HEPSETIA EVERMANNI (Eigenmann); type, San Cristobal, Cuba.
Figure 6. ATHERINA WOODWARDI Jordan and Starks; type, Okinawa, Riu Kiu, Japan.
Figure 7. ATHERINA TSURUGÆ Jordan & Starks; type, Nagasaki.
Fig. 8. ATHERINA PANATELA Jordan & Richardson; type, Calayan Island, Philippines.

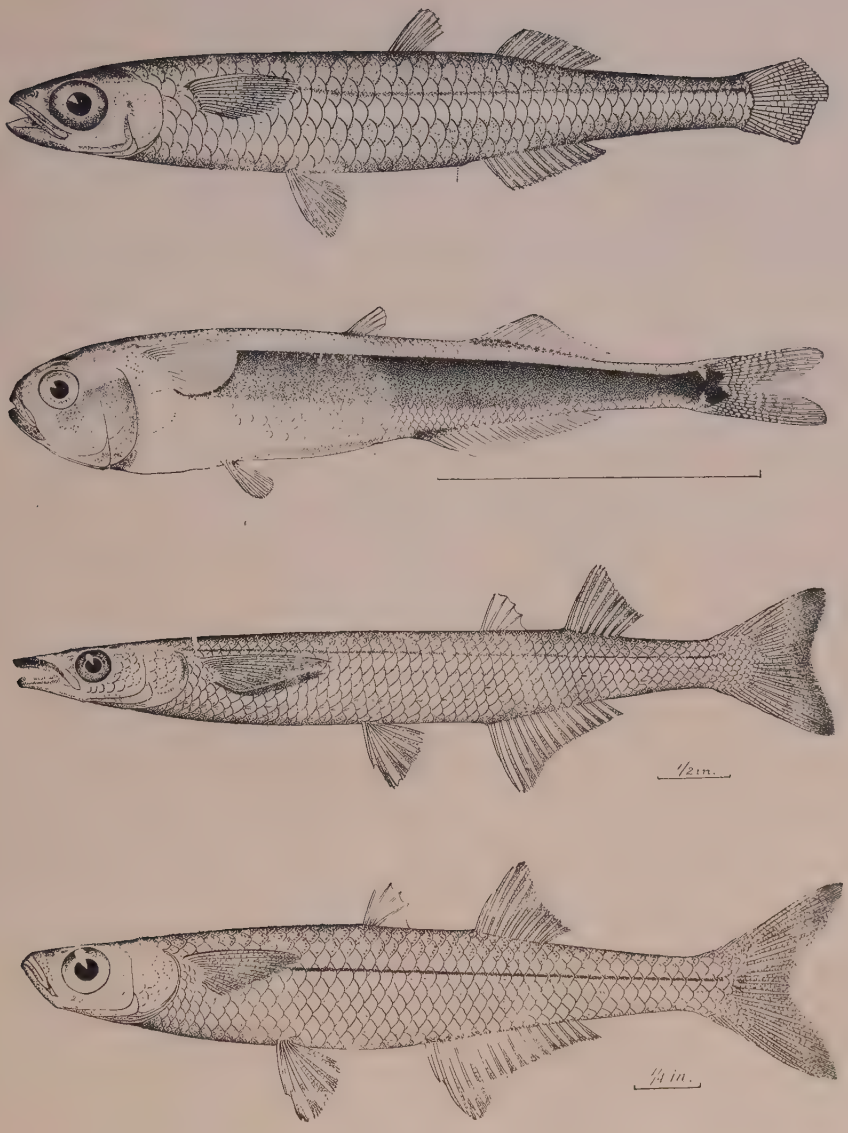


PLATE III.

Figure 9. ATHERINA ARÆA Jordan & Gilbert; type, Key West.
Figure 10. ISO FLOS-MARIS Jordan & Starks; type, Enoshima, Japan.
Figure 11. ODONTESTHES PERUGIÆ Evermann & Kendall; type, Argentina.
Figure 12. MENIDIA BERYLLINA (Cope); Potomac R.

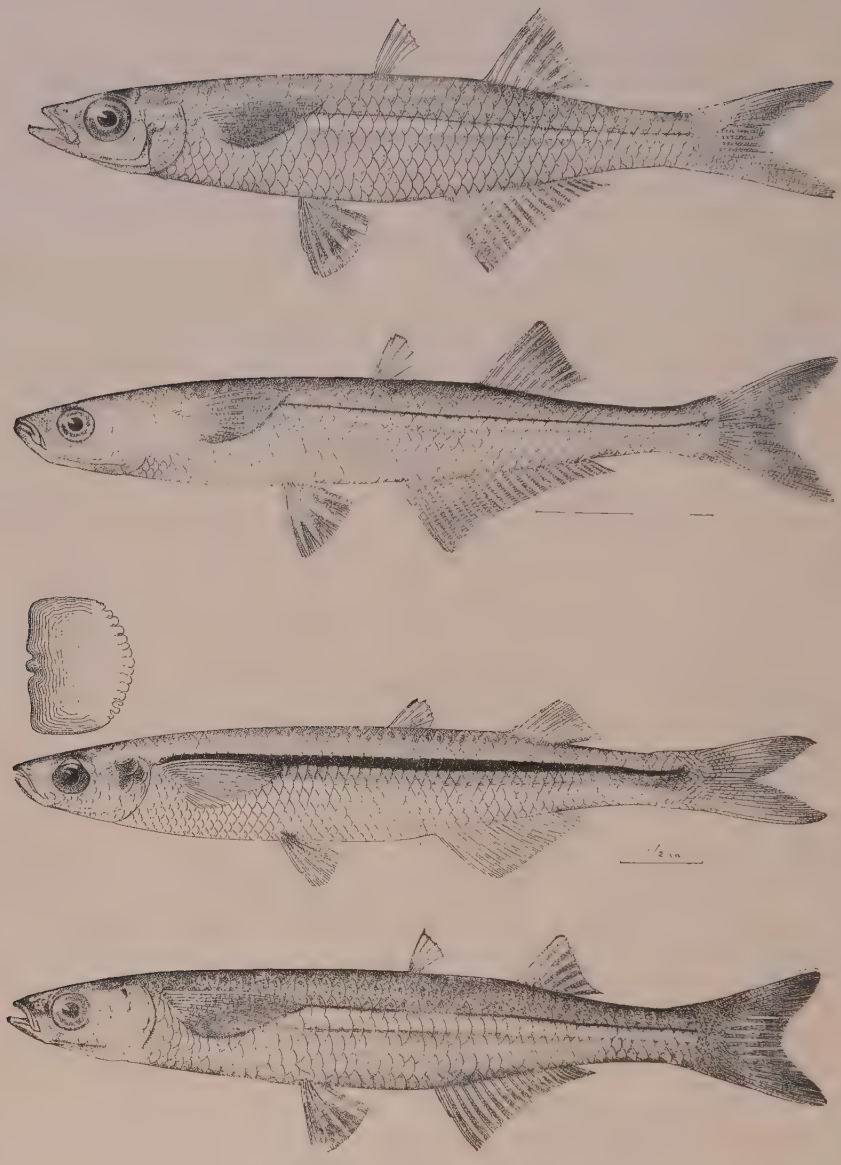


PLATE IV.

Figure 13. MENIDIA PENINSULÆ Goode & Bean; Pensacola.
Figure 14. MENIDIA NOTATA (Mitchill); Wood's Hole, Mass.
Figure 15. HUBBESIA GILBERTI (Jordan & Bollman); type, Panama.
Figure 16. MEMBRAS VAGRANS (Goode & Bean); Pensacola.

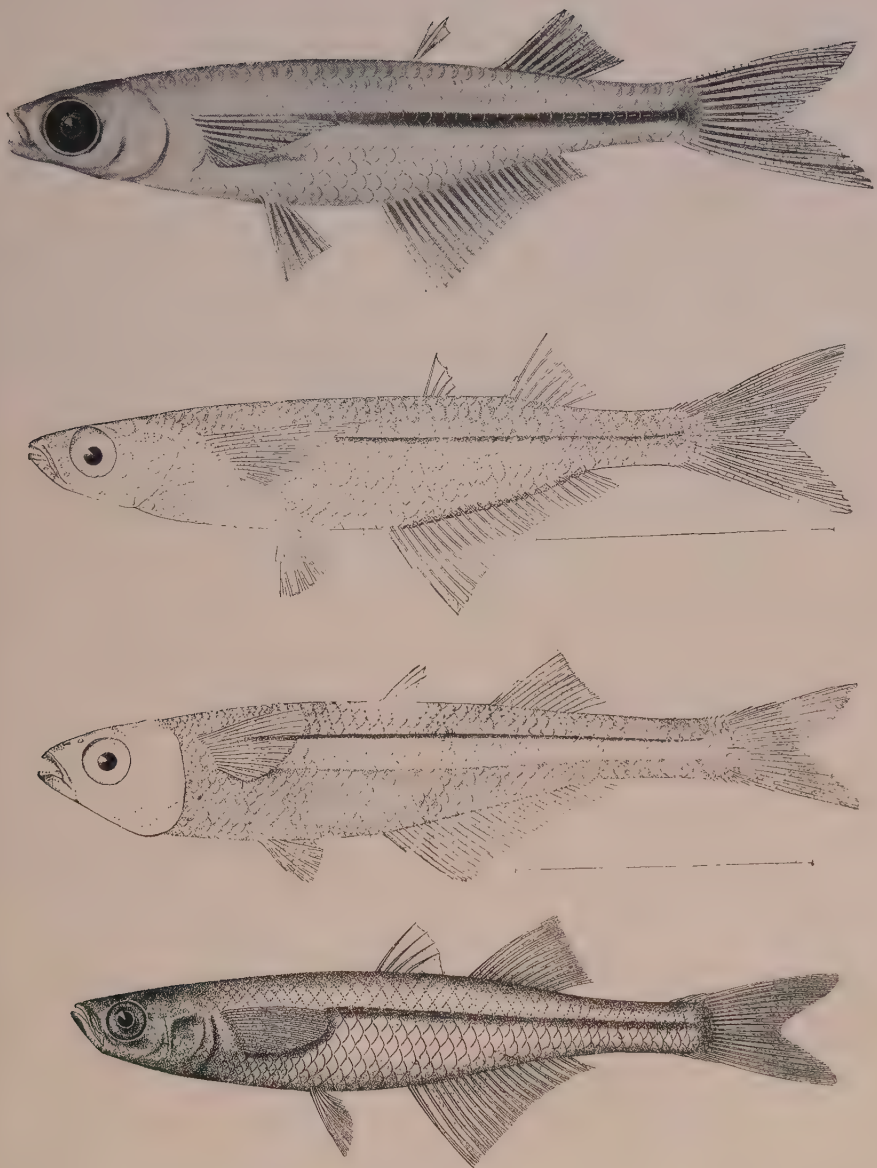


PLATE V.

Figure 17. THYRINA BALSANA (Meek); type, Rio de las Balsas, Balsas, Guerrero.
Figure 18. THYRINA EVERMANNI Jordan & Culver; type, Astillero de Rio Presidio, Mazatlan.
Figure 19. EURYSTOLE ERIARCHA (Jordan & Gilbert); type, Mazatlan.
Figure 20. CHIROSTOMA MEZQUITAL Meek; type, Durango.

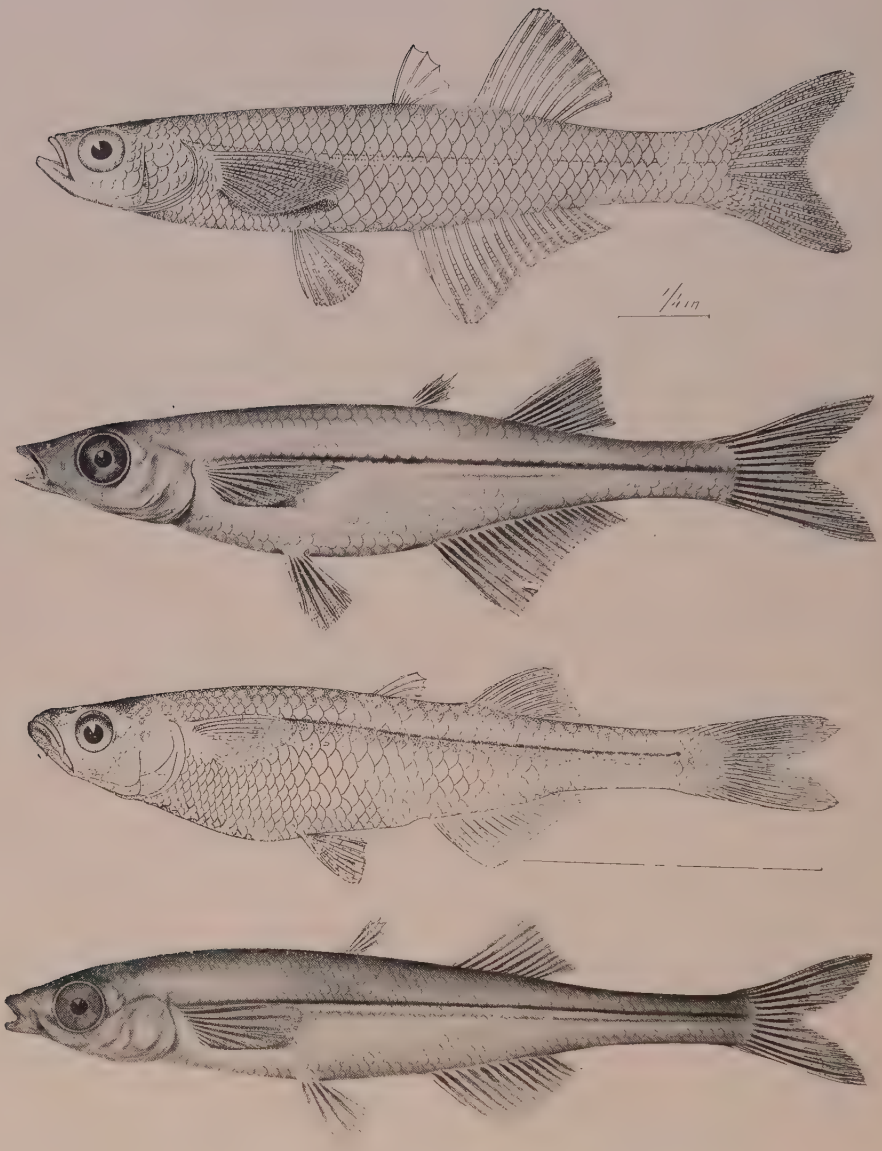


PLATE VI.

Figure 21. CHIROSTOMA JORDANI Woolman; type, Salamanca, Mexico.
Figure 22. CHIROSTOMA LABARCÆ Meek; type, Rio Lerma, Labarca, Jalisco.
Figure 23. CHIROSTOMA ARGE Jordan & Snyder; type, Rio Verde, Aguas Calientes, Mexico.
Figure 24. CHIROSTOMA BARTONI Jordan & Evermann; type of CHIROSTOMA ATTENUATUM Meek, Lake Pátzcuaro, Michoacan.

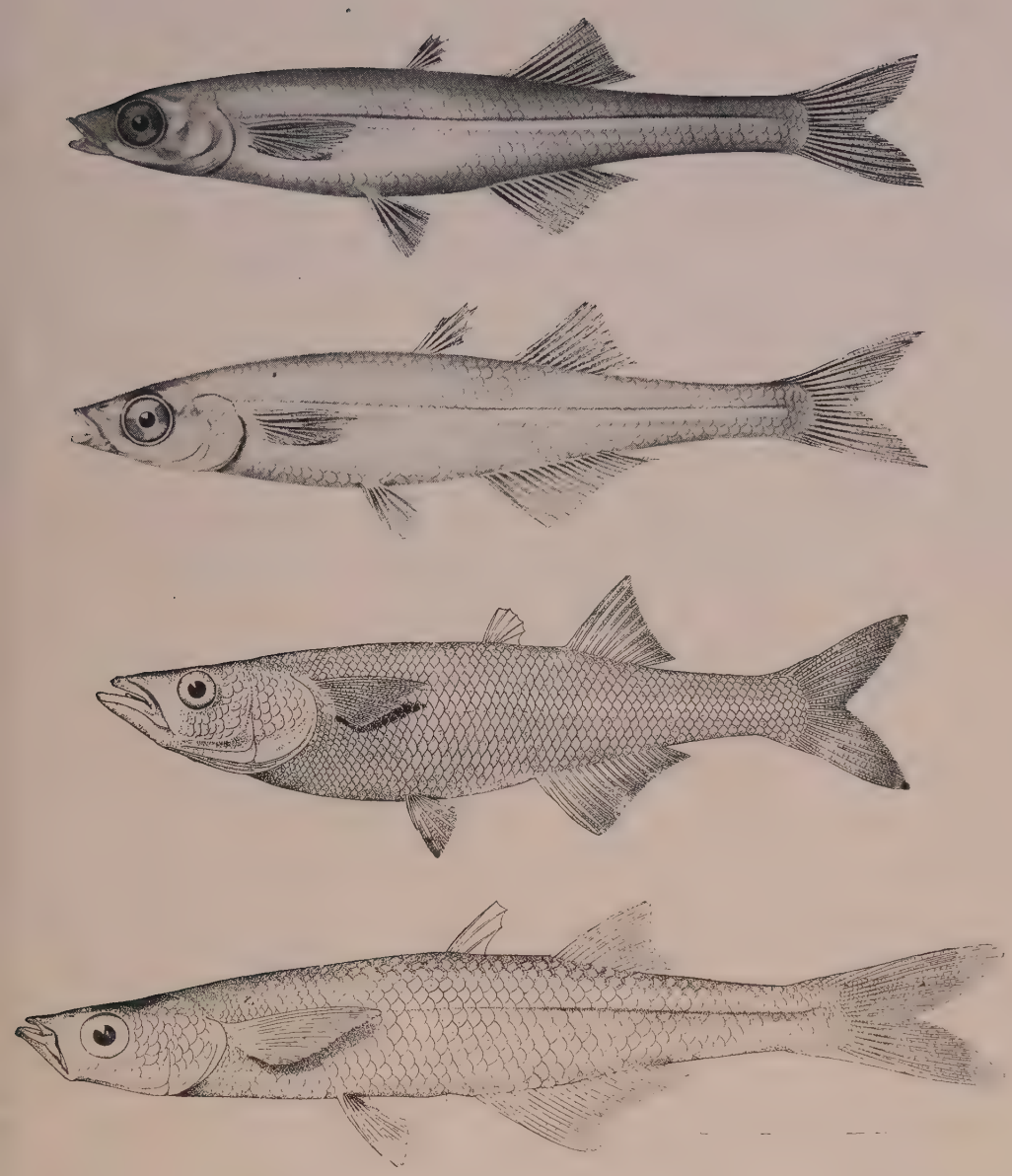


PLATE VII.

Figure 25. CHIROSTOMA ZIRAHUEN Meek; type, Lake Zirahuen, Michoacan.
Figure 26. CHIROSTOMA PATZCUARO Meek; type, Lake Patzcuaro.
Figure 27. CHIROSTOMA HUMBOLDTIANUM (Cuvier & Valenciennes); Lakes, Valley of Mexico.
Figure 28. CHIROSTOMA CHAPALÆ Jordan & Snyder; type, Lake Chapala, Jalisco.

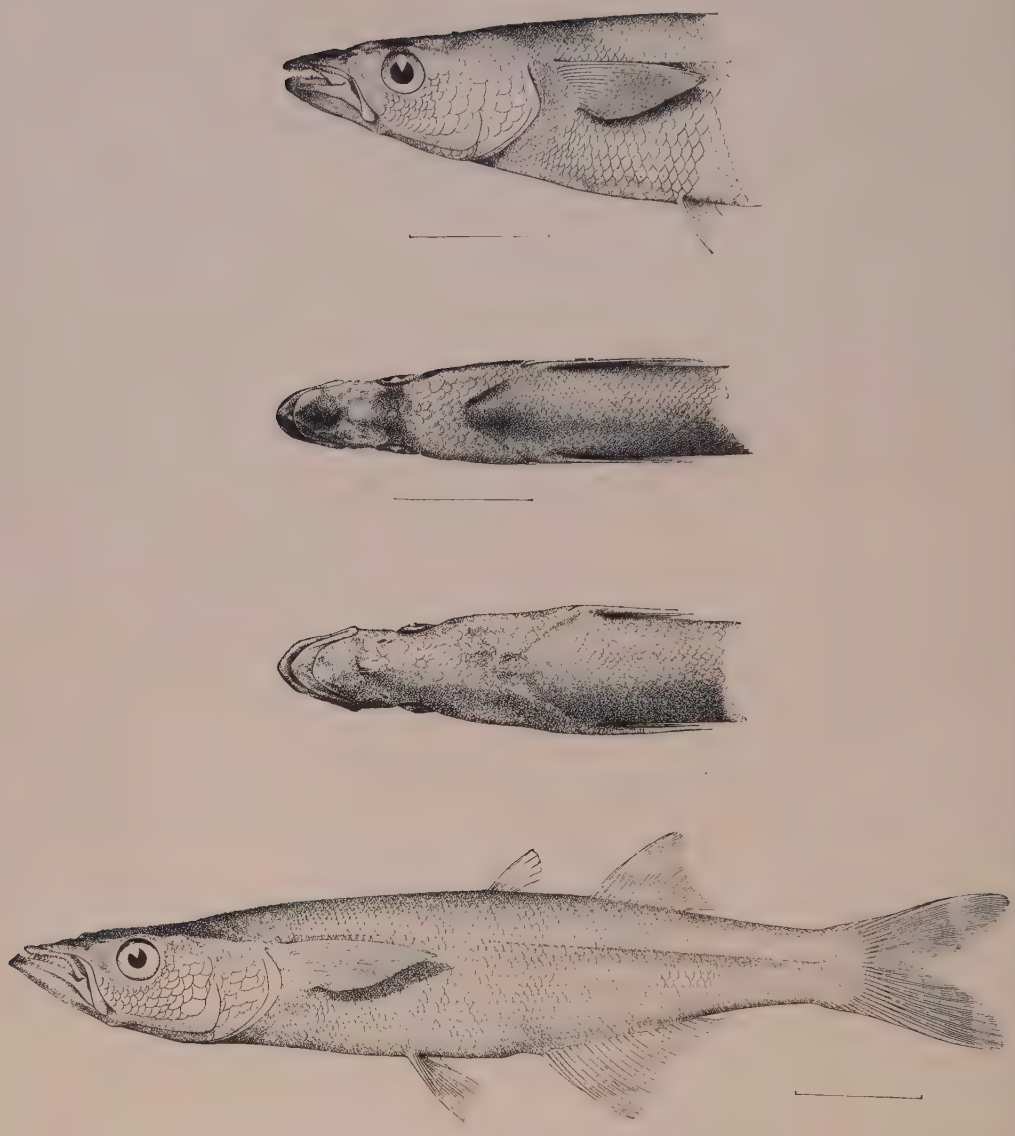


PLATE VIII.

Figures 29, 30. CHIROSTOMA PROMELAS Jordan & Snyder; type, Lake Chapala, Jalisco.
Figure 31. CHIROSTOMA LUCIUS Boulenger; type of CHIROSTOMA CRYSTALLINUM Jordan & Snyder, Lake Chapala.
Figure 32. CHIROSTOMA DIAZI Jordan & Snyder; type, Lake Chapala.

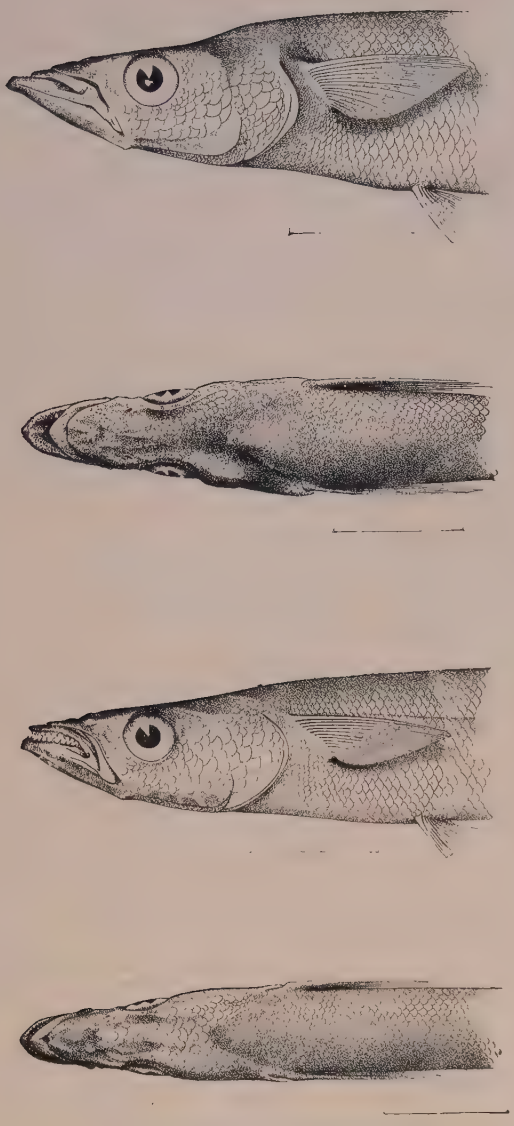
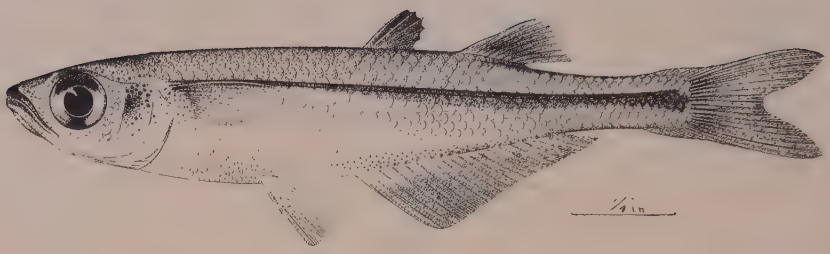


PLATE IX.

Figures 33, 34. CHIROSTOMA OCOTLANE Jordan & Snyder; type, Lake Chapala, Ocotlan, Jalisco.

Figures 35, 36. CHIROSTOMA SPHYRÆNA (Boulenger); type CHIROSTOMA LERMÆ Jordan & Snyder, Lake Chapala.



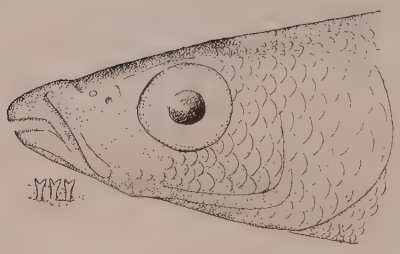


PLATE X.

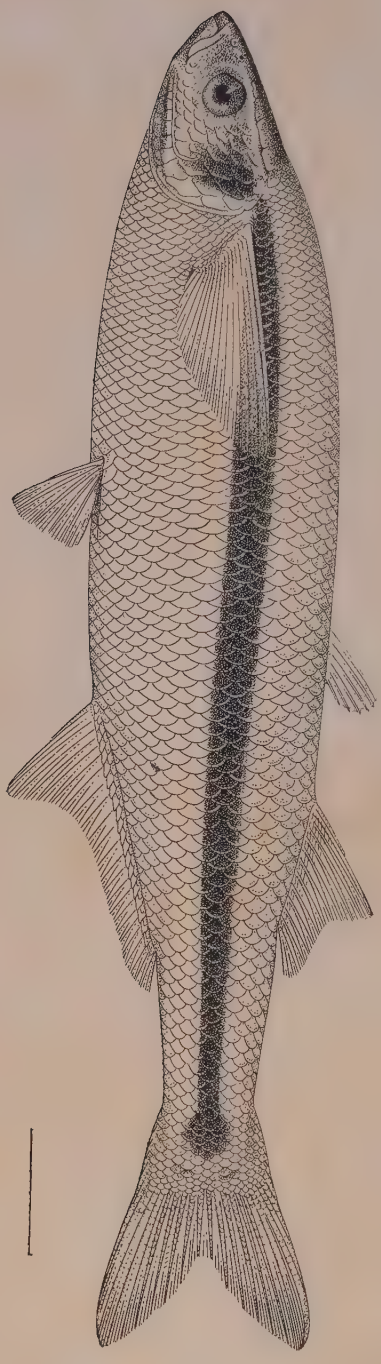
Figure 37. XENATHERINA LISA (Meek); type Rio Tonto, Refugio, Vera Cruz. (The scaling is represented as too complete, most of the scales along sides being mere rudiments.)

Figure 38. ATHERINOPS AFFINIS (Ayres); San Francisco.

PLATE XI.

Figure 39. LEURESTHES TENUIS Ayres; Long Beach, California. (Photograph: the small first dorsal buried in sheath of scales.)

Figure 40. ZANTECLITES HUBBSI Jordan & J. L. Gilbert; type, fossil, Miocene rocks, Bairdstown, Los Angeles.



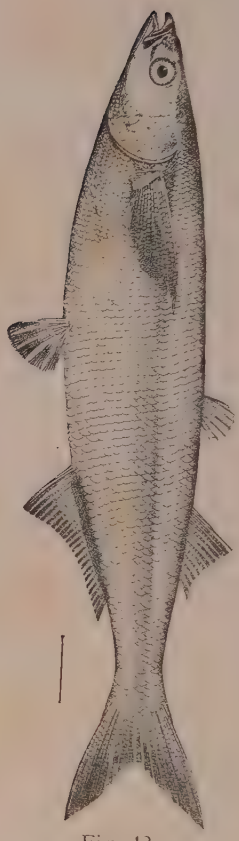


Fig. 42

PLATE XII.

Figure 41. ATHERINOPS AFFINIS (Ayres); type of ATHERINOPS OREGONIA, mouth of Yachats River, Oregon.

Figure 42. ATHERINOPS CALIFORNIENSIS Girard; San Diego.

UNIVERSITY SERIES

THE SESAMOID ARTICULAR: A BONE IN THE MANDIBLE OF FISHES. Edwin Chapin Starks, Assistant Professor of Zoology. 40 pp., 15 text figures. 1916. Price 50c.

A STUDY OF GERMAN VERBS COMPOUNDED WITH AUS, EIN, ETC., AS CONTRASTED WITH THOSE COMPOUNDED WITH HERAUS, HINAUS, HEREIN, HINEIN, ETC. Charles Reining, Instructor in German. 142 pp. 1916. Price $1.00.

THE PATHOLOGY OF NEPHRITIS. William Ophüls, Professor of Pathology. 103 pp., 64 text figures and plates. 1916. Price $1.00.

BONE AND JOINT STUDIES, I. Leonard W. Ely, Associate Professor of Surgery, and John Francis Cowan, Assistant Professor of Surgery. 139 pp., 41 text figures and plates. 1916. Price $1.00.

A STUDY OF THE MAGMATIC SULFID ORES. C. F. Tolman, Jr., Associate Professor of Economic Geology, and Austin F. Rogers, Associate Professor of Mineralogy and Petrography. 76 pp., 7 text figures, 20 plates. 1916. Price $1.00.

THE GENERA OF FISHES, FROM LINNÆUS TO CUVIER, 1758 TO 1833 (SEVENTY-FIVE YEARS), WITH THE ACCEPTED TYPE OF EACH. David Starr Jordan, Chancellor Emeritus. 161 pp. 1917. Price $1.00.

THE USE OF YE IN THE FUNCTION OF THOU IN MIDDLE ENGLISH LITERATURE FROM MS. AUCHINLECK TO MS. VERNON. Russell Osborne Stidston, late Acting Instructor in English. 95 pp. 1917. Price 75c.

EMERSON: A STATEMENT OF NEW ENGLAND TRANSCENDENTALISM AS EXPRESSED IN THE PHILOSOPHY OF ITS CHIEF EXPONENT. Henry David Gray, Associate Professor of English. 110 pp. 1917. Price 75c.

THE NEO-CLASSIC MOVEMENT IN SPAIN DURING THE XVIII CENTURY. Robert E. Pellissier, late Assistant Professor of Romanic Languages. 187 pp. 1918. Price $1.00.

THE ORIGINAL VERSION OF "LOVE'S LABOUR'S LOST," WITH A CONJECTURE AS TO "LOVE'S LABOUR'S WON." Henry David Gray, Associate Professor of English. 55 pp. 1918. Price 75c.

THE CALIFORNIA SPECIES OF MEALY BUGS. Gordon Floyd Ferris, Instructor in Entomology. 78 pp., 16 text figures, 3 plates. 1918. Price $1.00.

LIBERAL AND VOCATIONAL STUDIES IN THE COLLEGE. Henry Waldgrave Stuart, Professor of Philosophy. 72 pp. 1918. Price 75c.

THE DERIVATION OF THE FLORA OF HAWAII. Douglas Houghton Campbell, Professor of Botany. 64 pp. 1919. Price 50c.

A CONTRIBUTION TO THE KNOWLEDGE OF THE COCCIDAE OF SOUTHWESTERN UNITED STATES. Gordon Floyd Ferris, Instructor in Entomology. 66 pp., 38 text figures. 1919. Price $1.00.

THE GENERA OF FISHES, PART II, FROM AGASSIZ TO BLEEKER, 1833 TO 1858 (TWENTY-SIX YEARS), WITH THE ACCEPTED TYPE OF EACH. David Starr Jordan, Chancellor Emeritus. Pp. 163-284, with Index. 1919. Price $1.00.

THE ELECTRICAL CHARGES OF ATOMS AND IONS. Fernando Sanford, Professor of Physics. 130 pp. 1919. Price $1.00.

FOSSIL FISHES OF SOUTHERN CALIFORNIA. David Starr Jordan and James Zaccheus Gilbert. 64 pp. and 31 plates. 1919. Price $1.00.

THE GENERA OF FISHES, PART III, FROM GÜNTHER TO GILL, 1859 TO 1880 (TWENTY-TWO YEARS), WITH THE ACCEPTED TYPE OF EACH. David Starr Jordan, Chancellor Emeritus. Pp. 285-408, with index. 1919. Price $1.00.

STUDIES IN ICHTHYOLOGY, A MONOGRAPHIC REVIEW OF THE FAMILY OF ATHERINIDAE OR SILVERSIDES. David Starr Jordan and Carl Leavitt Hubbs. 87 pp. and 12 pp. plates. 1919. Price $1.00.

CONTRIBUTIONS TOWARD A MONOGRAPH OF THE SUCKING LICE, PART I. Gordon Floyd Ferris, Instructor in Entomology. 51 pp., 32 text figures. 1919. Price $1.00.

Library
NOAA, National Marine Fisheries Service
SWFC Honolulu Laboratory F/SWC2
2570 Dole Street
Honolulu, HI 96822-2396